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THE

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"WIRELESS" TELEGRAPHY.

IT is distressful to learn from the daily papers that, like the historical Irish patriot, the Wireless Telegraph Co. are now "agin the Government." Their present grievance would appear to be that the King's reply to President Roosevelt's recent and much pre-advertised aerogram could not be transmitted by their system. Why was not this possible? The divergent explanations which have been allowed to appear in certain of the daily papers upon this point are a little confusing. We gather from these that (1) there was insufficient electrical energy or potential available on this side; (2) that the company had declined to transmit the King's reply, because of the refusal of the Postal Authorities to afford them the convenience of a special wire; (3) that the Postal telegraph office in Cornwall nearest to Poldhu was closed for the night.

Explanation No. (1) may be dismissed from consideration, as the responsibility for such a miscalculation would rest with the company alone.

As regards explanations (2) and (3), it seems to be implied that the Postal authorities are in some way, and for some unknown purpose, obstructing efforts which are now being made to establish a new and beneficial means of telegraphic communication. Is it so? Surely, before the Post Office, of all Government Departments, can recognise and support with its authority any new system, postal, telegraphic or telephonic, its success must first be fully established, and this can only be done by demonstrations under given conditions, extending over definite periods, in the presence of Government officials and independent experts of repute. So far as we are aware, the Marconi Company has hitherto failed to recognise this necessity. Having now claimed to have established wireless communication between England and America, why does not the company offer some definite guarantee of its continuous and reliable working under independent observation from hour to hour, and from day to day, and week to week? Whatever the representatives of this company may be induced to say or think, they must be aware that grave doubts exist in the minds of experts of the commercial practicability of this most enterprising and ambitious scheme. To remove those doubts and to inspire public confidence in their projects, they might learn a useful lesson from the procedure followed with submarine cables. Take, for instance, the 1865 Atlantic cable. When this was projected, the feasibility and commercial value of submarine telegraphy had for years been established (which is not the case with "wireless"); but nevertheless, the contract stipulated that after the cable was submerged a lengthy message should be transmitted and received, without break or failure, in the presence of a jury of electrical experts and directors at either end of the cable. In addition, the cable was guaranteed to work perfectly and continuously for a period of 30 consecutive

days. Even now, with the improved cables of to-day, the latter stringent condition is still in force, and in many cases the duration of this probationary period is increased. Is the Wireless Co. prepared to secure the confidence of the Post Office and other authorities by affording them the opportunity to carry out similar tests under the conditions and for the periods considered necessary? If it does so, and if it successfully withstands the ordeal, then, but not till then, will the company have placed itself in a position to demand from any Government the concession of rights equal to those now enjoyed by the existing and firmly established systems of land and submarine telegraphy. The remedy lies in the company's own hands, and we fear that until it avails itself of it, the ordinary average man will construe the fact into an unwillingness on the company's part to submit its system to the independent tests which the public interest, of necessity, demands of all new inventions. And he may conclude that the paragraphs now going the round of the daily press are simply intended to cloak the causes which so far have placed King Edward in a less fortunate position than President Roosevelt as regards the transmission of wireless messages across the Atlantic.

An International Patent Examination System.

Mr. John S. Seymour, formerly United States Commissioner of Patents, proposes in the *Yale Law Journal* for December a startling innovation in the procedure for granting patents. Most civilised countries have now come to the conclusion that patents should only be granted after a careful search has been made to ascertain that the invention to be patented is new. In the United States and Germany this system of effective examination has long been in force, and many other countries such as Sweden, Austria and Japan have followed their example. England still lags behind with the result that about half the patents granted in this country are for inventions that are not new and therefore public property. We have, however, recently taken a step in the right direction by passing an Act to establish a system of examination, though we are still too timid to take action upon the results of this examination, *i.e.*, we communicate the results of the search to the inventor, but we do not refuse him his patent however unfavourable the results of the search may be. Such being the state of affairs, Mr. Seymour appears to be justified in telling us that our opinions on the economics of patent law belong to the Elizabethan age.

The labour of making a search to ascertain whether an invention is new is great, and is becoming every year greater owing to the vast amount of technical literature which is everywhere being published. This material has to be classified and examined in every country where a system of examination is in force. Thus when an inventor applies for a patent for the same invention in the United States, England, Germany, Austria and Sweden, the same search will have to be made in each of these countries. This means that a huge amount of labour is wasted, since a thorough search made in one of these countries should furnish sufficient ground for granting or refusing the patent in all the other countries where application for a patent is made.

Mr. Seymour's proposal is to establish some kind of co-operation between the Patent Offices of different countries to avoid useless waste of labour. His indications of the means by which his proposal is to be carried out are somewhat vague, but the idea is good, and it ought not to be impossible to get over the practical difficulties. Joint action, as he points out, has already been established in the matter of foreign mails, ocean cables, arbitration of international disputes and on many other matters.

The universal patent office could not only do quicker and better what the separate patent offices now do, but when international action in patents was once established it would inevitably lead to a great reduction of the burdensome fees which an inventor has at present to pay when he wishes to protect his invention in foreign countries as well as in his own.

The Metric System.

Two different points are involved in this question discussed last Thursday at the Institution of Electrical Engineers, and ought to be kept distinct. The decimal system of notation, and the c.g.s. units of measurement. Excepting Sir Frederick Bramwell, whose judgment we think is warped by training and by a natural inaptitude for calculation, we know of no one whose opinion has weight, who would prefer our present methods of calculating and stating quantities to the decimal system. Though ten is a bad basis of notation, it is the only one practically possible. It is difficult to understand why we tolerate the £. s. d. notation for money, when we actually possess a nearly perfect system of decimal coinage. Reduce the value of the penny in gold by one twenty-fifth part, and make a new coin of the value of 2½d., called say a groat. Then £1 = 10 florins = 100 groats = 1,000 farthings, and every existing coin is as useful as before, excepting perhaps the threepenny bit. Those who sell fixed things for a penny, the Post Office, the bus company, the merry go-round, and the automatic weighing machine, would suffer, and the general gain would be enormous. While our present money system, which concerns everyone, remains in use, it is hard to believe in any violent and general desire to change all our weights and measures merely to secure a decimal system. When a decimal system is introduced into money, however, it had better be done in other things at the same time, and most easily by adopting the metric system. The metric units are less convenient than our own, but they form a connected structure, and are extensively used.

We do not know exactly what is meant by adopting a metric system. Does it mean that after a certain date contracts in other measures could not be enforced, and that the public authorities would not allow their use in retail trade?

Experiments Wanted.

There have been of late years many claims for high efficiency in connection with all kinds of machinery. It is very doubtful whether some of these very high efficiencies can be substantiated.

Where the friction of a steam engine has been set down as low as 4, and even 3 per cent., the suspicion naturally arises that by some slip the calculation has been based upon the number of revolutions of the engine instead of upon the number of piston strokes in the same time; this would exactly account for the discrepancy.

Engine friction is made up of several items. Perhaps the main loss is the friction of the main bearings when there is a heavy fly-wheel. It ought to be easy to make experiments upon this item by disconnecting the rods and running the fly-wheel up to a given speed, and noting the time taken for it to come to rest from various speeds. In this way would be determined the friction at different speeds, and that at the working speed might be deduced. Easier still, the power might be determined by means of a motor, which could be attached to any hollow crankshaft with little difficulty.

It ought to be possible to determine the amount of piston friction in a hot cylinder at a low speed by means of a portable weighing machine, somewhat of the Denison type. The

apparent weights of a piston, when lifted, and again when lowered, will differ by twice the ring friction. This experiment, done first with the rod packings in place, and afterwards with them removed, should serve also to show the gland friction. The additional friction of the cross-head and crank pins might be found by conducting the first experiment with the piston rod disconnected in the case of a horizontal engine; the crosshead guide friction might be approximated at various positions by loading the block to the equivalent of the angular rod pressure, as calculated from the indicator diagram corrected for inertia. There would then remain only the valve gear as the least determinate item, especially when of the flat type. Piston valve friction may be weighed by difference as in the case of the main piston. Opinions will differ as to how far it is justifiable to neglect steam pressure effects on the main bearings. Do these diminish friction on the up stroke in the same proportion as they increase it on the down stroke? There are two points at which it seems probable that friction may be greatly augmented by carelessness. One of these points is the rod gland, which may be severely gripped; another is the piston when of the positively set out type. Hence the modern style of piston packing, which consists of rings turned accurately to the cylinder diameter, and set out by internal spring rings. Even if certain points may be indeterminate, there is little doubt that the items determined would show that abnormally low engine frictions of 4 per cent. and under cannot be considered correct.

Precautions Against Fire.

ONCE again the country has been horrified by the news of a disastrous fire—a holocaust—resulting in the death of over half a hundred wretched creatures, in the presence of their guardians, who were able and willing to protect them from almost all ordinary dangers, but powerless in the face of the most terrible of all, and the most pitiless.

A supernatural visitor, unacquainted with earthly conditions, coming upon the scene where such a tragedy was being enacted, would conceivably suppose that fire was either an evil for which no remedy was possible, or that it was an entirely new and previously unheard-off phenomenon, against which it had not been possible to provide safeguards for lack of time. Imagine his bewilderment on learning that fire was familiar to man from the earliest days, and that we, a race of beings capable of reason, and claiming to possess feelings of affection for one another, had locked up hundreds of our fellow creatures in a "temporary" erection—seven years old, and ideally combustible—and that these poor creatures were *imbeciles!* That automatic appliances were in existence, some for giving warning at the very commencement of a fire, while the danger was as yet potential rather than actual, and others for instantaneously extinguishing the flames—yet that none of these were fitted, and that the safety of the inmates depended upon the vigilance of the attendants!

It seems incredible.

It would be idle to talk of "the lesson to be learnt." There is no lesson. The sad event merely gives us a new insight into the negligence from time to time manifested by those whose duty it is to provide against such disasters, and who in wiser, if more barbarous, days would have been held responsible with their lives for the fulfilment of their duties. For a trivial outlay these wooden buildings—if nothing but wood would serve—could have been provided with automatic alarms, and for a somewhat greater amount hydraulic sprinklers could have been fitted which would have extinguished the flames at their birth. To omit such obvious precautions in the face of such awfu risks was a grave neglect of duty.

THE COMMERCIAL MANAGEMENT OF ELECTRICAL TRAMWAYS.

By C. H. WORDINGHAM.

THE first of two articles by Mr. T. W. Sheffield, under the above title, is published in the current number of *Feilden's Magazine*. He expresses the opinion that great advantages might be obtained by better attention to the commercial management of tramway undertakings, although, even in their early stages, highly satisfactory results are in most cases being attained.

Mr. Sheffield quotes certain figures, chiefly estimated, relating to the Manchester tramways, and very properly emphasises the importance of each department in a municipal undertaking resting on its own merits, deprecating the bleeding of one for the bolstering up of another.

As regards profits, they should certainly, as Mr. Sheffield says, be devoted rather to the development of the undertaking than to the relief of the city rates. It is a safe general principle that money earned from one section of the ratepayers should be used for their benefit, and not for the general body, though, unfortunately, it is a principle not often acted upon.

A tabulated statement of the views held by engineers and others interested in electric traction on questions propounded by Mr. Sheffield is given. Those relating to the carriage of goods are of considerable interest, and show much divergence of opinion. Mr. Sheffield himself is strongly in favour of this development, and he enumerates its advantages and the conditions which should be fulfilled by an ideal system.

The question of the carriage of goods on tramways may be divided into two distinct branches, according as light parcels or heavy materials have to be collected and transported. Both problems are hedged round with difficulties, and are largely influenced by local conditions.

There would seem to be no great difficulty in arranging to carry light parcels between definite points on the network in receptacles provided on the ordinary cars. For inter-urban traffic it should be possible to profitably charge very low rates for the service, and the advantage to the public would be great; but within a town it is doubtful whether it would be worth while to utilise the cars, as it would be quite impracticable to collect from and deliver to the individual houses. If a distributing system has to be established, it is difficult to see what advantage there would be in bringing the parcels to a depôt, transferring them to the cars, then handing them over to another depôt, and thence to the distributing wagons. The extra handling of the goods for the sake of transporting them a couple of miles on the cars would hardly be justified, and it would probably be substantially cheaper to do the whole of the work with the distributing machinery.

For heavy goods, again, inter-urban lines ought to be of material use, but much will have to be worked out to make the idea a practical success. A great difficulty arises from the fact that the passenger traffic must be worked at a high speed if the public is to be attracted, whereas it would not be economical to transport heavy goods rapidly. A carefully devised timetable, with passing places at suitable intervals on the lines, might be a solution, and others will probably be devised.

In large cities the transporting of heavy goods on rails through the ordinary streets presents most serious difficulties, except at night, and the hours of no passenger traffic are already very short—from, say, half an hour after midnight to 5 a.m. There are objections also to continuous service from the point of view of the dwellers in the suburbs, who already find the nuisance from noise at night well-nigh intolerable.

It is very doubtful whether Mr. Sheffield's dream of the carriage of coal, building materials, &c., through cities on tramways will ever be realised. It certainly could not be on the ordinary lines on which the passenger traffic is already nearly as dense as it can well be in the central areas. It might be feasible to set apart certain streets for rail traffic only, but it is more likely that wagons or lurries running on the ordinary road surface will be used, as they are very much more flexible, both as regards collecting and delivery, as well

as in ability to pass one another and work in among the ordinary traffic—if there be any ordinary traffic left in the mechanically-propelled, wholly utilitarian, hideously ugly future, so cheerfully foreshadowed. How these motor-cars will be worked, whether by steam, gas, oil, or electric propulsion, and whether they will be wholly or partially self-dependent, remains to be seen.

There is a small portion of Mr. Sheffield's article dealing with the generation of energy for electric traction to which it is necessary to call attention, as it bristles with fallacies which are shared with him by large numbers of persons, and are intensely mischievous. There are many who think that the arguments advanced by the advocates of combined lighting and traction stations are overwhelming; not so Mr. Sheffield, who does not apparently admit this view at all, saying that it is "no doubt" better for the tramway department to generate their own power. And why? Simply and solely for fear there should be a mistake in making out the bill!!!

The first great fallacy that underlies much that is written on this subject is the assumption that the average cost of production of energy in a station supplying a mixed demand is any guide to the cost of production of the energy used for any one purpose. Traction undertakings generating their own energy do not, cannot, and never will, produce that energy so cheaply as it would be produced in a combined lighting and traction station. What they pay for it is another matter; what they ought to pay can be arrived at very easily, but a discussion of this matter would require an entire article.

To begin with, assume that no alteration is made in the traction and lighting plant. Can it be contended that any additional expense is entailed by bringing all the plant under one roof? On the contrary, will not the cost of an enlarged building be less than that of two smaller ones? In nearly all cases the same plant can be used for either purpose in turn, and actually simultaneously if high pressure transmission is necessary. In consequence, a substantial reduction in the amount of standby plant can be made, and larger generating units become possible with attendant economy.

Similarly, the number of standby boilers can be diminished, and the radiation losses, which are much heavier than seems to be ordinarily realised, can be practically halved. One engineer can look after the combined station as well as after either the traction or lighting. No more men are required in the combined station at hours of light load than at either of the separate ones. The expenses for stores and storekeepers, and of repair shops, are practically halved, and there are a number of minor advantages accruing from combination that need not be enumerated.

The average cost of production in a combined station will be more than the cost in a purely traction station, and less than in a purely lighting station, but the average cost in a combined station will be substantially less than the average of the cost in a purely traction station and in a purely lighting station serving the same loads, and there will be a considerable saving to both undertakings. In other words, the cost of producing the traction energy in a combined station will be substantially less than if it were produced in one solely devoted to traction, and the cost of producing energy for lighting will be less than in a purely lighting station.

The next fallacy to which attention should be called is the idea that a traction load provides a steady demand on the station for some 16 hours out of the 24. Many alluring estimates of costs have been prepared on this basis, but those whose imaginations were fired with them are having a somewhat rude awakening, and are discovering what ought to have been self-evident and was patent to anyone who took the trouble to consider the question for himself, namely, that the amount of traffic varies greatly during the day, there being two considerable peaks in the morning and evening respectively and a lesser one at midday. Now a peak is a peak, and it is very striking to observe what an effect even a moderate one has on the load factor. A traction load is not much, if at all, better than a factory motor load, and is far inferior to that arising from street lighting.

To speak of a system requiring "a constant load for 300 or more cars" for 15 or 18 hours per day, as Mr. Sheffield does, is to conjure up a condition of affairs which does not exist in this, or probably any, country. Incidentally it may be remarked that the lighting station which he so disparages and which has a load for 12 hours per day for six months in the year is a figment of the imagination which will make the mouths of most central station engineers water most painfully.

Exception is taken to the tramways department paying the interest and upkeep charges on the traction feeders. Surely it is quite equitable for this to be done as these mains are allocated to the exclusive use of the department, but payment should not, of course, be made for any portion of the cost of the lighting mains in addition.

The portion of the article dealing with cost of generation concludes with a remark that one would like to have further elucidated, namely, that "many generating stations will need to be so extensive in the near future that it will become imperative for tramway departments to provide their own generating plant." This is entirely contrary to the generally received opinion that the larger the station the more economically it can produce electrical energy, though the present writer himself has doubts as to whether there may not be some critical capacity beyond which it is undesirable to go in a single station.

While being compelled to take strong exception to Mr. Sheffield's views on the generation of energy, which is actually a side issue of his theme, one is impressed with the main object that his article is devoted to show, namely, the great possibilities of development that exist for tramways beyond the mere carrying of passengers.

ELECTRICAL CASES IN 1902.

[From a Legal Contributor.]

(*Continued from page* 122.)

In the case of Maxwell *v.* The British Thomson-Houston Co., Blackwell & Co. third parties (18 T.L.R. 278), a Town Council who were the owners of tramways entered into a contract with a contractor whereby the latter undertook to do the whole of the work of equipping the tramways for electric traction. The contractor entered into a sub-contract whereby the sub-contractors (Messrs. Blackwell & Co.) undertook to do part of the work—namely, the erection of the iron standards along the streets and the fixing of the wires thereto. For this purpose the sub-contractor made use of a tall derrick, and his workmen, on leaving off work, negligently left the derrick too close to the tramlines, with the result that the plaintiff, who was riding on a passing tramcar, was injured. He brought an action against the contractor to recover damages. The Court of Appeal have decided that as the work was being done on a highway, it was the contractor's duty to take reasonable precautions to protect the public, and that he could not escape from that duty by delegating the work to a sub-contractor; that the act of negligence was not merely casual or collateral; and that the defendants were liable in damages.

This case illustrates the well-known principle of law that it is not always possible for a contractor, by the mere delegation of part of his work to a sub-contractor, to exonerate himself from all liability. Highway authorities have often been mulcted in damages, by reason of negligence on the part of contractors, employed by them to repair the roadway.

The case of Rattee *v.* Norwich Electric Tramway Co. (18 T.L.R., 562) is of general interest by reason of a curious argument which was put forward in an endeavour to excuse a tramway company from the consequences of a street accident. The plaintiff's horse was frightened by the approach of the defendant's car at a rapid pace. The plaintiff held up his hand, and shouted to the driver of the car to stop until he could get past it. The driver of the car, disregarding the signal, drove the car on without any stop or abatement of pace, whereupon the plaintiff's horse, when the car was close upon him, swerved round so that the trap came into contact with the tram. The plaintiff was thrown out and injured.

In defence to an action brought by the injured man for damages, it was urged on the part of the tramway company

that the tramway was being worked under Parliamentary powers, and that there was no statutory provision as to stopping or slowing down, when approaching a horse and trap which was clear of the tramlines. A distinction was sought to be drawn between a motor and a tramcar, the former being required by statute to stop or slow down when requested to do so. At the trial, however, the jury found a verdict in favour of the plaintiff for £854, and judgment was entered for that amount.

The tramway company was also unsuccessful in the Court of Appeal, where Lord Justice Vaughan-Williams, in the course of his judgment, said:—"In the present case the Legislature has authorised the user of tramways on this highway, and, if the accident had merely arisen from the use which was authorised by statute, I should be disposed to agree with the argument advanced on the defendants' behalf. But it is plain that this is not so. What is authorised is the use of tramcars on the highway in a proper manner, and taking proper care; and the jury have come to the conclusion that the driver did not take proper care, and that if he had taken proper care the accident would not have happened. . . . In my opinion, there is no pretence for the proposition that because the company were authorised to run tramcars on the highway, their drivers were exempted from the common law obligation to take reasonable care not to injure persons lawfully using the highway." It may sometimes appear to be singular that whereas railway companies are given express power to create nuisances without any redress to the public, tramway companies must comply with the requirements of the common law. This seeming anomaly is explained, however, when we remember that in obtaining the right to run trams along the highway the company only obtains a privilege which must be exercised in common with, and with due regard to, the requirements of the public.

The law reports for 1902, do not give much aid to the solution of the numerous questions which arise from time to time between supply company and consumer. There are, however, one or two decisions which call for notice.

The case of Edmundson *v.* The Mayor, &c., of Longton (19 T.L.R. 15), raised a very important question as to the rights and liabilities of persons who take a supply of gas, upon the "penny-in-the-slot" system. The principle laid down in the case would apply equally well to the supply of electricity by an automatic meter. It appeared that the respondents, who supplied gas within their own district, erected upon the appellant's premises an automatic slot meter, fitted with index dials, which registered the quantity of gas passing through it, and there was a box attached to the meter into which shillings could be dropped. On each occasion when a shilling was dropped in, a certain quantity of gas was permitted to pass through the meter. The respondents were the only persons who had the right to open the box, the key of which was kept by them. When the respondents' inspector came to collect the money, the meter showed that 19s. worth of gas had been consumed, but there was no money in the box. It was proved that the money had been stolen, but not through any negligence on the part of the appellant. The respondents claimed, in Petty Sessions, to recover from the appellant, and did recover, the sum of 19s. for gas supplied. On appeal to the Divisional Court, the Lord Chief Justice said that he understood the contract to be "that the repondents said to the appellant, 'If you put a shilling into the slot, you shall receive one shilling's worth of gas.'" In these circumstances he held that the only duty imposed on a customer was to put his money in the slot, and not to be negligent, and as there was no evidence of negligence, he thought that the decision of the magistrates was wrong, and that the appeal should be allowed. There does not seem to have been any written agreement under discussion in this case. It therefore emphasises the importance of having a proper contract drawn up between the company who supplies, and the consumer who uses a slot meter. If there was no negligence on the part of the consumer when the meter was tampered with, it is also obvious that the supply company cannot have been guilty of any negligence which gave the thief an opportunity of breaking into the machine. Unless it be shown that a meter is of such a design as to be easily tampered with, no supply company should be liable for the loss inflicted by burglars. A clause inserted in the consumer's contract would obviate the necessity of going to law.

The case of Husey *v.* London Electric Supply Corporation (1902, 1 Ch. 411), raised the question as to whether an electric supply company are bound in all cases to supply current to the Receiver in charge of premises which formerly belonged to a limited company. In the case under notice it appeared that the Court had appointed a Receiver of the undertaking and property of a hotel company, at the instance of the debenture holders. The order directed that the company should deliver to the Receiver possession of the hotel "so far as is necessary for the purpose of the receivership." At that time electric current for lighting the hotel was being supplied by a lighting company, and a large sum was due to them from the hotel company for current already supplied. The company refused to continue to supply the hotel unless the Receiver entered into a contract. Under Sec. 19 of the Electric Lighting Act, 1882, no person within the area supplied with electric current by an electric lighting company is entitled to a supply unless and until he has entered into a contract with the company for the purpose. It was decided by the Court of Appeal, reversing the decision of Mr. Justice Kekewich, that the company were entitled to discontinue the supply of current, until the Receiver had entered into a new contract with them for its supply.

The case of the British Electric Traction Co. *v.* Inland Revenue Commissioners (1902, 1 K.B. 937), raised the question whether an annual payment of money in respect of electric current is to be treated as "rent" within the meaning of Sec. 77, Sub-Sec. 2 of the Stamp Act, 1891. It appears that by a lease of tramways to the plaintiff company by a municipal corporation, which was made pursuant to the Tramways Act, 1870, the company were to pay rent at a fixed rate per cent., on the cost of the original purchase. They were also to pay to the lessors a given sum per mile of road along which the tramways were laid, in lieu of repairing any portion of such road, and maintaining the tramways, except the rails and electric bonds laid thereon. The minimum amount payable under this clause was £900 per annum, and a power of distress was reserved in respect of it. They were also bound to purchase from the vendors all electrical energy required for the purpose of the tramways, and to pay for the same at a given rate, the minimum sum payable in any one year being £4,000. It was decided by the Court of Appeal (*inter alia*) that the £4,000 payable in respect of the supply of electrical energy was not rent, but that it was payable under a covenant made in further consideration for the lease, within Sec. 77 Sub-Sec. 2 of the Stamp Act, 1891, and that the instrument was not chargeable with *ad valorem* duty in respect of it.

The case of the Finchley Electric Light Co. *v.* the Finchley Urban District Council (418, T.L.R. 449), which came before Mr. Justice Farwell in the Chancery Division on March 18th, raised the question whether a company who supply electricity for lighting purposes under no provisional order or special Act, have the right to suspend their mains across the highway without the consent of the highway authority. The plaintiffs in the case under review carried a wire across a road at a height of more than 30 ft. above the road, and the Urban District Council contended that the fee simple of the land on which the road was, was vested in them, and that the company had no right to carry a wire over it. As they made out their title to his satisfaction, Mr. Justice Farwell entered judgment for the Council. There is more in this case than meets the eye upon a perusal of the report. The plaintiff company, unable to obtain a provisional order, endeavoured to supply electricity in Finchley, where there is no public supply. The Urban District Council had obtained a provisional order, but had never put it into force. The object of these proceedings, which were commenced by the forcible removal of the plaintiffs' cable, was to freeze out the plaintiffs. Seeing that the learned judge deprived the District Council of costs, it is evident that he was not favourably impressed by their tactics.

Dartford.—The U.D.C. has adopted a flat rate for electricity for motive purposes of 2½d. per unit, with a minimum charge of 5s. per horse-power per quarter, for each motor connected up.

REVIEWS.

The Scientific Writings of the late George Francis Fitzgerald, Sc.D. F.R.S., Hon. F.R.S.E.: Collected and edited with an historical introduction by JOSEPH LARMOR, Sec. R.S. Dublin: Hodges, Figgis & Co., Ltd. London: Longmans, Green & Co., 1902.

The scientific papers and contributions to newspapers and reviews of the late Prof. G. F. Fitzgerald have been published in a collected form, with notices of his life and work, under the editorship of Prof. Larmor. There are in all 108 papers, and most of them deal with the principal scientific problem of the day, the nature of the ether. Many are addresses, reviews, and newspaper articles, and have little or no permanent value, but the biographical notices by the Editor and Sir Oliver Lodge will always be read with interest. The volume opens with a lament by the latter over the apparent waste of intellectual power involved by the expenditure of such a mind as was Fitzgerald's on the routine work of examinations, committees, letters, and newspaper articles, and Fitzgerald submitted to demands on his time for purposes of this kind to an extent exceptional even for a University Professor. Sir Oliver Lodge says that our system is to expend great intelligences in this way, and that they are not necessarily wasted. The same policy that put Anselm, the brightest intellect of his time, to rule a disorderly church in a rebellious country, has entrusted to Lodge the organisation of a school of commerce in Birmingham. England has inherited from the Normans the Roman tradition that the maintenance and development of civil order are of paramount importance, and Englishmen who have shown exceptional mental power in their own pursuits are constantly compelled to sacrifice those pursuits to the demand for administrative capacity. Many eminent scholars have been butchered to make indifferent material for one of our political parties. Here and there men are so entirely detached by distaste from affairs that they cannot be brought into effective contact with them, and a Darwin, a Faraday, or a Maxwell does what appears to be his peculiar work. It is possible that Fitzgerald's human spirit found a necessary stimulus in intimate contact with the work of other men, and without it would have been sterile; but one lays down this book with regret that a large part of the record of a very acute and sympathetic intellect should be of so trivial a character.

Colliery Manager's Pocket-Book for 1903. Edited by R. A. S. REDMAYNE, M.Sc. London: *Colliery Guardian* Co., Ltd.

This is the 34th year of publication of this useful pocket book, which contains valuable tables of statistics; an interesting article on mechanical coal-cutting, including a note on electrical machinery, in which polyphase plant is specially recommended; engineering information of a most varied and practical nature, full directions for the use of explosives, &c. The electrical section is signed by Mr. T. Campbell Futers; apart from some minor slips in the diagrams of connections on pp. 168-9, and in the definitions, the section is worthy of high commendation. The wording is concise and practical, and the matters dealt with are just those which are of most interest to the class of readers concerned. We think that the brief allusion to polyphase machinery for mining might, with great advantage, be replaced by a more comprehensive treatment of this important subject in future issues, and information relating to electrical pumping, coal-cutting and haulage should be included.

Fowler's Electrical Engineer's Year Book, 1903. Manchester: Scientific Publishing Co. Price 1s. 6d.

This hand-book contains a large amount of information on all branches of electrical engineering, and has been considerably enlarged. The algebraic treatment of the insulation resistance of installations on pp. 30—33 might be omitted, as it is quite out of place in a practical reference book; the same may be said of the theory of the tangent galvanometer and of Lord Kelvin's graded tangent galvanometer. Careless mistakes occur in the pages dealing with magnetic calculations; for instance, on p. 114, the leakage coefficient is omitted from formula (3), though it is inserted lower down, and on p. 115 a grave error occurs—the multiplication of the flux in the armature by the leakage coefficient, in finding the flux in the air-gap. As usual, in pocket books, apocryphal tables of permeability are given; seeing that the compilers of these books (including the one under consideration) claim that "annual publication affords a convenient opportunity for revision," we cannot understand why so much obsolete and misleading matter is allowed to remain year after year. New matter is not so necessary as the genuine and painstaking revision of the old.

An extraordinary mistake is committed on p. 129, where the diagrams of lap and wave winding are interchanged. On the following page objection may be raised to the use of the term "re-entrant," but it must be added that the matter is quoted from Mr. Wiener, who is responsible for the misquotation from Messrs. Parshall and Hobart's "Armature Windings."

Besides sections on dynamos, alternators, lamps, &c., space is devoted also to electric traction, steam boilers and engines and allied matters, and a directory of electricity works in the United Kingdom. The numerous quotations from papers read before the various branches of the I.E.E., and from last year's periodical literature, bear out the statement that much new matter has been added, and, in spite of a few errors, the book is certainly good value.

Guide to the Practical Elements of Electrical Testing. By J. WARREN. London: S. Rentell & Co., 1901. Price 3s. 6d.

This is a reproduction in book form of a series of articles on practical elementary electrical testing, which have recently appeared in *Electricity*. The book consists of 200 pages of matter with about 90 illustrations.

It would be manifestly unfair to judge a work of this kind by comparing it with several recent treatises covering the same ground, published at four or five times the price, and, judged on its merits, we think the book should prove useful to students of electro-technics who do not care to purchase a more expensive work.

The material of the book is, on the whole, well chosen, and the information given fairly accurate, but the literary style throughout leaves much to be desired. Why people, who set up to teach the elements of a science and to write what is claimed to be a practical book, adopt the style here employed, we entirely fail to understand. For instance, what can one make of the sentence which begins on page 7, threads its way through some diagrams on page 8 and finishes on page 9?—

> In order to render this instrument independent of the earth's magnetism, and consequently more sensitive still, it has been constructed in "astatic" form, as indicated in fig. 5, where *a b* and *e f* represent two coils, so connected as to exercise a similar comboned (*sic*) influence upon the system of magnets, N S, which is doubled in this type of instrument, one set being attached as before to the back of the mirror *c*, and the other, an equal and similar set, with their N and S poles in an exactly opposite direction to those of the foregoing are attached at a negligible distance below, to the face of a small aluminium vane, *g*, which oscillates with the mirror and aluminium wire support, and is closely surrounded by a small similarly-shaped chamber, closed, or nearly closed, on all sides, the interior surfaces of which only just clear the edges of the vane *g*.

The reviewer remembers arriving at a small German university town, and looking from his hotel across the market-place to a store opposite, saw inscribed across the building the awful word

"Haushaltungshanddringmaschinegeschaeft."

This, we think, breaks the record for even a German word, but in competition with some of Mr. Warren's sentences it is simply nowhere.

The author seems also inordinately fond of long and out-of-the-way words and Latin phrases, where plain straightforward Anglo-Saxon would have been much more appropriate, and there is a strong tendency toward an irritating redundancy throughout the book, such words as

"*modus operandi*," "excerpted," &c., occurring again and again. These are, however, faults which could easily be remedied in a subsequent edition.

The illustrations are on the whole very good, many of them being reproductions from copyright blocks of representative types from instrument makers' catalogues. Also in nearly all cases where an instrument or method of test is described, a diagram of connections is given. The last 50 pages are probably the best part of the book, and form a very useful summary of the tests and methods employed in telegraphic and electric light work. Full descriptions are given regarding such matters as the use of Price's guard-wire and the calibration of commercial ammeters and voltmeters.

Practical Electrician's Pocket Book for 1903. Edited by H. T. CREWE, M.I.M.E. London: S. Rentell & Co., Ltd. Price 1s.

This handy little book has been revised and extended, chapters on wireless and other telegraphy and on polyphase motors having been added. As we have previously indicated, the matter consists rather of general information than of rules and tables; it covers a remarkably wide range of subjects in a concise and interesting manner, and the book itself is very neatly got up.

The Slide Rule. By R. G. BLAINE. London: E. and F. N. Spon, Ltd. 1903. Price 2s. 6d.

This is the second edition of a useful guide for beginners to the use of that invaluable instrument, the slide rule. Besides this, the prime object of the work, shortened methods of arithmetical calculation, and the use of logs, are explained, and a table of four-figure logarithms has been added. A variety of worked examples is given to illustrate calculations in different technical subjects.

CORRESPONDENCE.

The Fuel Value of Town's Refuse.

I have read with much interest Mr. Frank Broadbent's comments upon my article in the December number of *Page's Magazine* on the "Fuel Value of Town's Refuse."

A careful perusal of Mr. Broadbent's very interesting and instructive contributions to the literature of this subject which appeared in several numbers of your journal last year would, I think, show that there is really not much difference between the ways in which both Mr. Broadbent and myself regard the question of the utilisation of town's refuse as a fuel. My remarks in *Page's Magazine* were intended to lay stress upon the fact that a "refuse destructor" should be looked upon primarily as a means of effecting a complete combustion of the refuse of a town, and a thorough cremation of any gases arising therefrom, with as little delay as possible, and that the efficient carrying out of these principles militated against the use of a destructor as a means of firing steam boilers for any purpose requiring a steady steam pressure under a varying load, except in cases where the minimum amount of heat available from the combustion of the refuse under the conditions above cited is in excess of the maximum requirements for electric lighting or other purposes.

My whole argument is simply this: that the "man in the street" should not be led to think that because evaporative trials of refuse-fired boilers have shown an average evaporative power of half a pound or one pound, or whatever it may be, of water from and at 212° F. per pound of refuse, they can rely upon getting half a pound or one pound of steam, as the case may be, at constant boiler pressure, for each and every pound of refuse fed into the destructor furnace. If I have read Mr. Broadbent's articles aright, he will not differ from me upon this point.

I do not for one moment suggest that refuse contains no heat value, nor that the heat of combustion should not be turned to account. Without wishing to take up a controversial attitude, I may perhaps be permitted to point out that while it is quite true that water actually can be—and, in fact, is—evaporated from the refuse destroyed at Torquay and in London (at Shoreditch), I think Mr. Broadbent will find, if he inquires closely into the matter, that there are times when it is perfectly impossible to get any evaporative power whatever from the refuse, while at other times and seasons no doubt the evaporative power rises to something higher than 0·71 and 0·96 lb. respectively.

The results obtained at Nelson are, I think, quite exceptional, owing to the quality of the refuse, and were really in my mind when I wrote the following words:—"If the heat utilised is arranged not to greatly exceed the minimum heat output of the furnace, there will obviously be no difficulty in utilising this for purposes requiring a constant boiler pressure, and in these circumstances the utilisation of steam from a refuse-fired boiler need not interfere with the functions of the destroyer as a sanitary appliance."

I think if Mr. Broadbent will at his leisure look into the figures obtained at Nelson he will admit that the following statement of mine (to which he takes objection) is in effect quite correct. The statement in question is, "There is no instance on record of steam for electric lighting or power purposes being continuously and satisfactorily drawn from a refuse-fired boiler to the extent indicated by a number of pounds of refuse burnt multiplied by the alleged evaporative power of the refuse per pound." To make this perhaps quite clear, I ought to have added the following words:—in the sense that coal can be so relied upon from year's end to year's end.

Mr. Broadbent considers my estimate of 40 lbs. of steam per unit generated as too conservative. I think that manufacturers of steam dynamos will be with me as regards this figure. I have been present at several tests in which the full load figures showed a consumption of considerably under 30 lbs. steam per kilowatt-hour, and even the quarter load consumption was but little over 30 lbs., and it seems to me from my own experience of the steam consumption per kilowatt generated, that 40 lbs. is a fair all-round estimate in good practice.

Mr. Broadbent objects to my subtracting 1,613 T.U. per lb. of refuse consumed from the calculated calorific value of the refuse in order to arrive at its net evaporative power, and says that the temperature which I have assumed for the issuing gases, namely, 1,500° F., is too high, and that this should be 500° F.

I think that again Mr. Broadbent's objection is more apparent than real. From a practical point of view, the evaporative power of a fuel should be calculated on the basis of the heat necessary to evaporate 1 lb. of water from the temperature of the feed after deduction has been made of all unavoidable heat losses. I have assumed the feed water to be at the temperature of 212° F., and have arrived at the net evaporative power of the refuse by dividing the calculated calorific value by 966 after deduction of the unavoidable heat loss, which I have put at 1,613 B.Th.U. Mr. Broadbent considers, however, that the loss in the issuing gases should be calculated on the temperature at the base of the chimney or after the products of combustion have passed through the economiser. It may fairly be assumed that in these circumstances the temperature of the feed would be raised to somewhere in the neighbourhood of 212°, but this is done at the expense of the lowering of the temperature of the products of combustion. It does not matter to what temperature the furnace gases are lowered (for the purposes of my argument) as long as you assume that the feed is thereby heated up to 212° F., and in taking my figure of conversion of 966 B.Th.U. per lb., I have credited the refuse with supplying the heat necessary to raise the feed to 212° F. I think Mr. Broadbent's misapprehension arises from the fact that he has looked at the heat loss from a somewhat different point of view to mine. For the purposes of my calculation I am really not concerned with the amount of heat which goes absolutely to waste up the chimney in the issuing gases, but with the amount of heat that has to be provided by each pound of refuse to satisfy the conditions under which it is burnt before any heat is available, net, for turning the water in the boiler into steam. It is clear that the refuse *must* supply the following quantities of heat:—

1. The amount necessary to evaporate the moisture.

2. The amount necessary to raise the temperature of the *combustible* portion of the refuse, together with that of the air necessary for its combustion from the temperature at which it is fed into the furnace to the temperature at which it leaves the furnace.

3. The amount necessary to raise the temperature of the *incombustible* portion of the refuse between the same temperature limits.

4. The amount going away in radiation.

Of these, Nos. 1, 3 and 4 are absolute dead loss. A portion of No. 2 is recoverable, and, in fact, is always recovered in the shape of heat imparted to the feed-water; but in calculating the evaporative power of the fuel from and at 212° F. I take account of the amount of heat so recovered.

There is always, of course, a considerable further expenditure of heat, which should be deducted from the net evaporative power in effecting the necessary forced draught, whether by means of fans or steam jets. I have purposely not taken this into account, because it is possible that in certain circumstances the necessary draught might be available from some other source (in the case, for instance, of a combined steam and refuse plant), and it would be difficult to fairly apportion the further deduction from the net heat available for evaporation on this account.

I venture to think, therefore, that Mr. Broadbent's criticism of my figures is based upon the fact that he assumes the temperature of his feed to be 212° F., while I have taken into account the heat necessary to produce feed-water of that temperature, having regard to the fact that the average temperature at which feed-water is obtainable is from 50° to 60° F.

The loss in heating up clinker is, of course, a very difficult matter to determine, and can only be taken approximately.

As regards the evaporation of moisture, Mr. Broadbent is with me in assuming 30 per cent. moisture as a fair average, so that in the whole calculation Mr. Broadbent practically agrees with me.

In expressing my appreciation of Mr. Broadbent's courteous reference to my few remarks in *Page's Magazine*, may I take this opportunity of making clear what perhaps has remained a little obscure, namely, that I do not for one moment wish to detract from the heat value of refuse, nor had I any intention of conveying by my article in *Page's Magazine* that refuse had no heat value, but that I merely wished to record my view that the essential feature of a refuse destructor was to get rid of the garbage of a town in the most complete manner from a hygienic point of view, and that the utilisation of the heat evolved by the combustion of the refuse should be a secondary condition and subordinate to the functions of the destructor as a necessary sanitary appliance.

Ed. C. de Segundo.

Dashwood House,
New Broad Street, E.C.

Tramcar Brakes.

An engineer of the Westinghouse Co. writes as follows:—

In connection with the article entitled "More about Brakes," published on 16th inst., in which you criticise matter published by *Engineering* on the car brake subject, the writer, whilst agreeing with the general opinions expressed in your article as to the indisputable merits of the Westinghouse Magnetic Brake, must take exception to those which declare this well-known tramway brake as not having yet "been subjected to the only real trial, that of life."

It is generally known amongst our tramway engineers that the Westinghouse Magnetic Brake has been in constant use on American tramways for the past four or five years, and in this country several tramway systems have used the brake for the past two years. In every case the results obtained have been uniformly satisfactory. The effect is that the present demand for the brake is very large; new customers and repeat orders are crowding in on the British Westinghouse Co., who have at the moment a large and busy section of their Manchester works engaged solely in the manufacture of their magnetic brakes.

How then can the statement that the *Engineering* article was "introducing a device which is on its trial" be upheld? The brake in question was introduced years ago, has been in rapidly increasing use ever since, and certainly cannot be said to be still on trial or to require "a year's experience of this brake," to demonstrate its value.

Under these circumstances the writer feels bound to protest against even the "*inclination* to caution" published by a journal of the high standing of the ELECTRICAL REVIEW regarding the general adoption of the Westinghouse Magnetic Brake. After stating so clearly the many characteristic advantages of the new brake, surely it would have been more reasonable, if advice had to be given, to counsel another course, especially when the only objection placed against its general use was that it was "untried."

Pupin's Telephone System.

In the ELECTRICAL REVIEW of December 12th and 19th, 1902, some very interesting particulars of experiments on the Pupin telephone system are given by Messrs. Dolezalek and Ebeling. In trying, however, to apply Dr. Pupin's formulæ to actual calculations, I notice that some very peculiar and unlikely results are obtained.

From his solution of the differential equation,

$$L\frac{d^2I}{dt^2} + R\frac{dI}{dt} = \frac{1}{c}\frac{d^2I}{dx^2},$$

Dr. Pupin obtains a value of the dynamometer reading

$$I = \frac{A}{\sqrt{2}}\sqrt{\varepsilon^{2\beta\xi} + \varepsilon^{-2\beta\xi} + 2\cos 2\alpha\xi}, \quad (1)$$

where $\xi = l - x$; l being the length of the line, x the distance from the speaking station, and A, β and α constants.

In this formula, if $x = 0$ and l is great, $\varepsilon^{2\beta\xi}$ becomes very great compared to $\varepsilon^{-2\beta\xi} + 2\cos 2\alpha\xi$,

so that (1) practically reduces to $I = \frac{A}{\sqrt{2}}\sqrt{\varepsilon^{2\beta l}}$.

That is, the formula shows that the current sent increases rapidly in strength in proportion to the length of the line, and this is obviously not possible.

And, further, formula (1) shows that the current received is entirely independent of the length of the line. To illustrate this, take $l = 100$, $x = 99$, then $l - x = 1$. Similarly $l = 1{,}000$, $x = 999$, gives $l - x = 1$, and $l = 1{,}000{,}000$, $x = 999{,}999$ gives $l - x = 1$.

So that formula (1) gives the current 1 mile from the end of the line the same no matter how long the line may be, or

$$I = \frac{A}{\sqrt{2}}\sqrt{\varepsilon^{2\beta} + \varepsilon^{-2\beta} + 2\cos 2\alpha} = \text{a constant},$$

since A, β and α are constants.

Admitting a certain resonance effect between the capacity and inductance, this effect cannot possibly extend beyond several wave lengths without attenuation, whereas this formula shows that alternations would be sent over a circuit of any length without the current received decreasing in proportion to the length of the circuit.

The inaccuracy of this formula does not decrease the interest or value of Dr. Pupin's experiments, which have been confirmed by other experimenters. But while the addition of inductance coils to a circuit increases the loudness of speech, I think it will be admitted that it at the same time decreases the clearness of the speech by destroying the higher order of harmonics; and that a certain limit is reached, when an increase of inductance diminishes rather than increases the value of the circuit.

W. Moon.

The Sugden Boiler.

The question of superheating in water-tube boilers raised by your correspondent, Mr. J. C. Stewart, is one of great importance. I do not, however, agree with the suggestion he makes to cut out the superheater by flooding, and making it part of the boiler, as this practice is open to very serious objections.

Where the water is sedimentary, it is impossible to prevent the deposit of incrustaceous matter which cannot be cleaned

out where small bent tubes, such as are usually adopted in connection with superheaters, are used. In consequence the tubes are liable to burn out, and in addition to this, the heating surface is rendered much less effective. I have had experience with tubes burning out from this cause.

Personally, I have no faith in any system of interlocking gear. I have had occasion to go carefully into this matter, and in all cases that I have investigated, I find they do not provide for all contingencies. As the result of my investigations, I have come to the conclusion that the remedy is worse than the disease. For my part, I prefer a superheater so arranged as not to require any flooding water to protect it, which I look upon as an evil to be avoided.

A. Anderson.

Westminster, S.W., *January 21st*, 1903.

Entropy.

In answer to Prof. Perry's letter, as to reference to Prof. Bryan's report, I will repeat what I said in my address :— "The study of reversible changes occupies most of the space in books on thermo-dynamics, just as the study of frictionless mechanisms throws light on engineering problems; but though it is numerically correct in the limiting and purely hypothetical case of reversibility, the equation $\int d\text{H}/\theta = \phi$ as a definition of entropy is fundamentally wrong. It gives a wholly wrong notion of entropy." It is quite clear that when Prof. Bryan says, in his report, "$d\text{Q} = \theta d\text{s}$ where $d\text{s}$ is a perfect differential of a quantity S called the *entropy*," he is referring to reversible changes, and, I have no doubt, exclusively to reversible changes. As I said in my article, I, of course, regard Prof. Bryan as a leading authority on thermo-dynamics, especially in connection with the structure of matter. What I stated was that his disapproval of my paper was owing to his not troubling to understand it, and saying $d\chi$ is not a perfect differential, whereas it is a perfect differential when $d\phi$ is, that is to say, in reversible changes.

Then Prof. Perry takes Prof. Bryan as an authority as to Prof. Perry's and Prof. Bryan's statement of the second law. I repeat that that statement, though not itself the second law, is perfectly accurate and unassailable in reversible changes, but not in irreversible changes. Prof. Bryan was discussing reversible changes only, though he, with the usual slackness of which I complain, does not say that his statements are limited to reversible changes. Prof. Perry, however, definitely asserts that his statement is true in irreversible changes; here I submit he is at fault.

Prof. Perry goes on "That Clausius used a term in one sense, and that all modern men use the term in another sense, is a matter perfectly well known." I will ask Prof. Perry to say when the change was made. The term entropy was coined by Clausius to denote a quantity which is a function of the co-ordinates, such that in an irreversible change $d\phi > d\text{H}/\theta$. Nomenclature is unimportant, it is the mathematical principle that is vital. Prof. Perry says there is a quantity which is now called entropy, which I will for the moment call x, such that $dx = d\text{H}/\theta$ in an irreversible change, and dx is an exact differential in an irreversible change, while x is also a function of the co-ordinates, or depends on the state of the working substance. These equations are inconsistent, apart from any nomenclature. But Prof. Perry's whole position is untenable; there has been no change whatever in the meaning of entropy. Lord Kelvin writes to the *Electrical Times*: "There can be no question as to what entropy is. It is Clausius's word. Persons concerned in it will find its definition in Clausius's own writings. It is the same thing as Rankine's 'thermo-dynamic function.'" Prof. Perry writes as if I were an eccentric minority of one. Clausius, not to speak of Kelvin, developed the second law of thermo-dynamics by reasoning on reversible cycles, and he coined the term and developed the whole idea of entropy, ϕ, such that $d\phi = d\text{H}/\theta$ in the hypothetical and non-existent case of reversibility, and $d\phi > d\text{H}/\theta$ in all real changes. Does Prof. Perry mean that Clausius recanted and withdrew his entropy before 1888, or did he never become a modern man at all, but die ineffectually leaving my humble self as the unworthy but solitary exponent of the false doctrine that the energy of the world is constant and the entropy always strives to increase? In other words, energy is conservative and its differential is always exact; entropy is not conservative, but in every change it increases, and its differential, in fact, is never exact. Anyhow, I do not feel lonely. The text-books on mathematical physics or on engineering are not the best sources of information on thermo-dynamics. I would refer anyone to treatises on thermo-dynamics, and have already mentioned, merely as specimens, Kelvin, Clausius, Gibbs, Duhem, van Laar, Planck and Helm. I might mention any number of others, no doubt, by looking through books on my shelves or going to a library for a large selection. But what is the good of that? Books on thermo-dynamics treat chiefly of reversible changes, and the more elementary do not discuss irreversible cycles at all. I know of no text-book on thermo-dynamics that discusses an irreversible cycle without showing that $(\int) d\text{H}/\theta < 0$. Can Prof. Perry mention any book on thermo-dynamics which states that in an irreversible cycle $(\int) d\text{H}/\theta = 0$, or that in an irreversible change $d\text{H}/\theta$ is an exact differential? Can he find any statement in any book on thermo-dynamics that Clausius's term entropy is used, not in Clausius's, but in another sense by even one modern man other than Prof. Perry himself?

James Swinburne.

41, Palace Court, W.,
January 25th, 1903.

The Bayonet Lampholder.

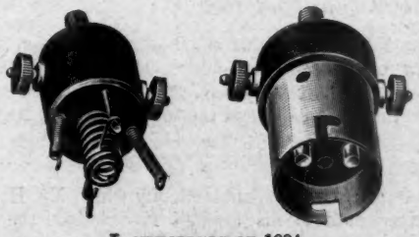
I notice in your issue of 16th inst. a letter from Mr. H. Bevan Swift on the above, and think that he is doing the right thing in drawing attention to this matter.

In the face of such a fatality as that which lately occurred at the Fulham Baths, and was attributed to a faulty lampholder, it is about time that serious attention was given towards improved construction of these universally used articles, as the result of the inquiry will undoubtedly do the industry harm and give our gas competitors an argument to use against us. Should another such fatality occur, one can hardly be surprised if the public begin to lose confidence in the safety of electric supply, particularly as the daily press never lose any opportunity of exaggerating matters.

In passing, I might mention that, in a matter of history, your correspondent is not quite correct; he states that the bayonet lampholder was originally designed for 50 volts; this is not so, and as the originator of the appliance, I am able to correct the assumption.

The bayonet lamp and holder were originally produced in May, 1884. The Edison-Swan 100-volt lamps (then more commonly known as the "high resistance") had been on the market about a year; it is true that 50-volt lamps were in more extensive use than the 100-volt, but they were all provided with platinum eyes.

It was owing to the clumsy lamp-heads, with fragile platinum eyes (more particularly that pattern having the unprotected platinum eyes arranged at the side), requiring a large unsatisfactory holder, that the need arose for something more reliable, mechanical and interchangeable, the result being the bayonet method of attachment, which ultimately became standardised.



Lampholders of 1884.

The woodcuts will show the articles I refer to. I am also sending you a sample of the earliest bayonet holder.

The bayonet lampholder, as will be seen, has been considerably improved upon for the higher voltages now used, but as Mr. Swift points out, the quality of workmanship in

some of the cheapest types has suffered of late years, and various faults develop in use.

It is very likely that the lampholder, in most cases, is made to bear all the blame, whereas the cause of trouble is really the plaster-capped lamp used with it.

The plaster cap is a delusion and a snare, and shows no advance on the original type; vitrite and porcelain caps are more perfect, electrically, owing to their vitreous nature, but owing to its hygroscopic failings, the plaster type should be condemned for exposed or damp situations, if not altogether, as leakage between poles, or to earth by means of the brass collar, is almost certain to occur.

With the exception of the adoption of the above materials, and the plasterless lamp caps now supplied, little has been done towards the improvement of the lamp cap, and the dividing rib, though a good idea, seems to have received but scant adoption.

If the plaster cap were tabooed in favour of vitrite or porcelain, with a rib between the poles, something would be done to make the appliance safer; but if a brass collar be found essential, it should not be allowed to pass muster, unless well below the level of the contact surfaces.

As Mr. Swift remarks, it is very curious that while such strict supervision has been given to other accessories, the B.C. lampholder and lamp collar are almost overlooked; the passing of the miniature type on 250 volts in some quarters is even more surprising, and appears to be another argument in favour of the production of a set of rules acceptable in all quarters. Of course, but little harm may be done in the event of a short circuit occurring, as the current passing before the fuse blows would be but small; apart from this, the inconvenience caused to the user by faults in the apparatus must be exasperating, and such possibilities of inconvenience occurring should be overcome in order to popularise electric supply.

Many besides myself have doubtless experimented with lampholders and caps on the principle Mr. Swift proposes, and in other ways, with the object of rendering them safer. The plan he proposes is undoubtedly an admirable one, and the best way out of the difficulty, but getting the lamp manufacturers to produce and stock a new type, in the face of the standard pattern, would be the chief stumbling block towards its general adoption; or if they did produce such, the cost would be more than the standard pattern, and the latter would soon put the newcomer out of the market.

Messrs. Downie & Adams some few years back placed on the market a lamp and holder of this side-contact type, and I expect they found considerable difficulty in advocating its adoption with the standard type holding the field.

It would, of course, be useless for accessories manufacturers to attempt the manufacture of holders on this principle if the makers of the most reliable lamps attempted the manufacture in a half-hearted spirit only. The Edison screw type is safer than the bayonet collar, but after such lengthened acquaintance with the latter, the former would never be generally adopted in this country.

The Thomson-Houston cap (if made slightly smaller) offers several points that might be adopted in an improved type, but the side contact, if properly worked out, is better.

No doubt a change would be for a time inconvenient, but in the face of such casualties the inconvenience to users would be a small matter in comparison.

A. P. Lundberg.

London, *January 23rd*, 1903.

[We would point out that the disaster at Fulham was not *attributed* to a faulty lampholder; this, or a faulty switch, was, literally, an accessory before the fact, but the essential fault was the neglect to earth the tubes.—Eds. Elec. Rev.]

I can quite understand the difficulty which Mr. H. Bevan Swift experienced in his attempt to persuade the lamp-makers to depart from the standard bayonet cap. In many respects it would be advantageous to use lamps such as he describes, with contacts arranged at the sides instead of on the face of the cap, and designed to fit into a lampholder suitably arranged to receive them. On the other hand, I think that all those who have tackled the lampholder problem from a manufacturer's point of view—to say nothing of lamp caps—will bear me out in my belief that any radical change is undesirable, and would be highly inconvenient.

On setting to work to design a lampholder, one is soon confronted with difficulties and limitations. To begin with the "nipple," which is really a socket, unless all fittings makers are to be asked to change their standard practice, this must be arranged to screw on to a ½-in. "brass" male nipple. Next the body of the holder, or the "tube" as it is known, must be slightly less than 1¼ in., or a request must be sent to the glass shade makers to abandon all their present designs of shades, and scrap their moulds and tools, the vast majority of which are all arranged for 1⅛ in. holes. The interior of the tube must be of such a diameter as will receive the porcelain (allowing here for variations in the baking of about $\frac{1}{64}$ in. either way) at one end, and admit the lamp cap at the other, again allowing a suitable margin. Another all-important consideration which must not be overlooked is that the public naturally prefers a lampholder of the minimum depth, and one neat in appearance. I have mentioned a few of the main difficulties only. There are, in addition, many other problems of detail connected with the "interior" as well as with the "case."

I may be wrong, but I firmly believe that the bayonet lampholder is here to stay. So much thought has been devoted and so much money spent upon this one small accessory, which is repeated in thousands of grosses turned out annually, that it would be strange if the ultimate stage in its evolution had not been reached.

Some two years ago my firm introduced a small improvement, which, without presenting any technical difficulty in manufacture, certainly renders the well-known "S" holders more suitable for higher pressures. In the two samples I am sending you will notice that the ordinary "S" holder has the opposite poles exposed where they face the lamp cap, involving the risk of short-circuit both from the contact plates and the rim of the cap, and also especially from wires protruding from the terminals. The other holder, known as the "Improved S" or "Aston" type, has this surface entirely covered with china, the plungers alone projecting. The terminals are located in the "base" or top of the holder, where there is ample room for them.

The subject is one of interest at the present moment, and of some importance, otherwise I would not solicit for this letter the hospitality of your columns. That I shall not be told it is in the *wrong* column, I base my hopes upon the fact that the "Improved S" holders are already well known to the trade, and very well supported by leading contractors.

M. B. Cotterell.
(Veritys, Ltd.)

Manchester, *January 21st*, 1903.

Gas Engines for Central Stations.

Referring to the remarks made by "Producer Gas" in the Electrical Review of 2nd inst., I would inform you that my firm, the United Electric Co., Vienna, has lately installed a small central station on the gas-generating system.

Each gas engine of 55 B.H.P. drives a 40-KW. dynamo, which is provided on one side with a commutator for direct current, and on the other side with three slip-rings for producing three-phase current. The armature has one winding only.

I have made extensive tests and have come to the following results:—

On an average the consumption of anthracite is 0·96 kg. per KW.-hour, and assuming for the dynamos and belts an efficiency of 87 per cent., we obtain per brake-horse-hour a consumption of 6·616 kg., amounting to 1·36 English lbs.

These figures are therefore greatly larger than those given by your correspondent.

The anthracite in the generating furnaces is mixed with coke in order to obtain greater economy.

I would point out that the figures given are not of such high standard as would be the case if the gas engines and dynamos were working with full load, which they do not, as

the supply as yet has not come up to expectations, and the sets are only giving one-half of their normal output.

Besides the above figures it may be of interest to give you the consumption of the other fuel, and of the oils employed.

For the generated kilowatt-hour measured at the bus-bars, I have on the average found the following figures:—Anthracite, 0·962 kg.; coal for boilers, 0·64 kg.; dynamo oil, 0·0019 kg.; engine oil, 0·012 kg.; cylinder oil, 0·0085 kg.

At a future time I hope to be able to supply some more interesting data.

Arthur Bloemendal.

Vienna, *January 22nd*, 1903.

[We shall be very pleased to receive further data from our correspondent.—EDS. ELEC. REV.]

Intermittent Currents for Electric Lighting.

Mr. S. H. Holden's article on pulsating current systems is very interesting to me, but he is in error in supposing that they have never been tried on any large scale. A reference to the Patent Office will show that in 1890-91 I described and illustrated a complete system of electrical distribution by "unidirectional intermittent currents," for which I hold also an American patent. I made considerable use of this current and tested most of the suggestions in the article of Mr. Holden.

The whole system was pronounced upon by experts as practicable but too complicated. I am much interested in its resurrection at this date.

Rankin Kennedy.

Leeds, *January 23rd*, 1903.

The Wiring of Buildings.

I would very much like to get your opinion on the low insulation test of some small jobs that I, in the position of foreman in an Edinburgh contract shop, had to see through the Corporation test.

In reading over this week's REVIEW *re* Mr. Falconar's paper on wiring of buildings in Class (A), about the middle of the column, you say, "The fact that moisture is due to condensation can be proved by observing the low insulation test obtained whenever there is a sudden fall of temperature."

Do you mean by this that a job of, say, 30 lights run in iron tubes with draw-in boxes, all tubes connected at switches and ceiling roses and well earthed, should give a much lower test on a wet day than on a dry day; at least, that is what happened with me, and this is only one job of several that did the same jump the other day. I had a half-flat house in a new building with 13 lights run in iron tubes and draw-in boxes. When this job was ready and tested by us we got 5 meg. When the inspector came four days after, he only got 1—3, and refused to pass it. I may say here that our instruments gave about the same test at the same time. The instruments are Evershed's 500-volt generator and ohmmeter, latest pattern.

The next day, a much drier day, we go back and test same, and get about 5 meg. again.

When we take off the switches and fuseboards and ceiling roses, we get a good test on the wiring, so the only thing that I can see to account for the difference is surface leakage on a wet day, but we can't convince the inspector that it is.

If you could see your way to get the opinion of some of your practical readers who, I have no doubt, have experienced the same on some of their jobs, you would be conferring a great favour on one of your constant readers.

Foreman.

Motor with External Armature.

I have read with interest your description of the new motor placed on the market by Messrs. Mavor & Coulson, particularly so as it appears to be identical with a machine I designed in 1896, and which is illustrated with considerable detail in the *Institution of Electrical Engineers Proceedings*, Vol. xxvi., p. 599 (discussion on Mr. Mordey's paper on "Dynamoes," read May 20th, 1897).

Taking the details referred to in your article, I have the stator type of armature stampings, with barrel-formed conductor in slots on the inner periphery. My field magnet has four poles, two being consequent exactly as you state, only that to illustrate some remarks I made in the discussion I show a method of laminating the magnetic circuit throughout. The hollow stationary shaft carrying the conductors to the magnet winding was in my sketch, also the method of placing the belt *direct on to the outside* of the armature, exactly as indicated in fig. 2, p. 87, in your issue of January 16th.

I may say that I have always believed there to be a future for this design of external armature machine, and am glad it is being pushed to the front by such a progressive firm as Mavor & Coulson.

E. Kilburn Scott.

Re Rebate Indicators.

I am connected with a place in the North of England where we have an installation of about 380 glow lamps, 10 arcs, and 2 Nernst lamps run off the Corporation mains, continuous current 220 volts. Their method of charging for current is as follows: The equivalent of 100 hours' usage of the maximum quantity in use at one time is charged at 6d. per unit, and the balance at 2d. Now, in our case, they have fitted two Chamberlain & Hookham 50-ampere meters and two Wright's rebate indicators. The result is, that for the last quarter we have received two separate accounts, one for each meter:—

Meter No. 1.—1,000	units at	6d.	=	£25	0	0 = max. demand.
2,876	„	2d.	=	23	19	4 = balance.
				£48	19	4 = total.
Meter No. 2.—1,390	units at	6d.	=	£34	15	0 = max. demand.
2,327	„	2d.	=	19	7	10 = balance.
				£54	2	10 = total.

in addition to which there is a charge of 3s. per meter for rental.

You will notice there is a difference of 390 units in the two rebate indicators. Now, sir, I maintain that the use of two rebate indicators is unfair to the consumer, as it is impossible to get a fair average on two, seeing that they are both practically on one supply. Can any of your readers give a case where such a charge was successfully contested? I have already particulars of one case where a substantial reduction was made. I may say that the highest amounts on the two meters were respectively 43½ and 63 amperes (50-ampere meters), each meter supplying current for one-half of the main distribution board.

H. Mitchell.

A Suggested Coherer.

The Castelli coherer is probably the most simple appliance of its kind in use, but it seems to me that a better, and equally simple, coherer could be constructed in the following manner:—Take two fiddle strings (G) and place them at right angles to one another, thus—

These strings, as is well known to musicians, are made of gut about the thickness of an E string, and covered with fine wire of copper or silver.

At the point where they touch they could be amalgamated with mercury, or rubbed with powdered carbon or plumbago, or small blocks of metal or carbon, with or without a mercury film between, might be affixed to the strings at the points of intersection, which naturally need not be exactly in the middle of the strings. Again, one string only may be employed, abutting against a piece of metal or carbon, with or without mercury. They can be screwed up, as on a violin or other kinds of stringed instru-

ments, to any pitch by means of pegs, and in this position of tension they can be made exceedingly sensitive in their motion. The fine wire, moreover, gives a certain amount of resistance, because, although the spirals touch, they become oxidised.

The lengths and tensions could easily be adjusted, or tuned, to give the best effect, and one string could be of copper wire, the other of silver, or both copper or both silver. Three, four, or *n* number of strings might be employed, and possibly good effects might be forthcoming if they were placed touching side by side instead of at right angles, but that would be a matter for investigation. It might be said that solid wire would do, but solid wires could not be brought into such a high state of tension and quiver with life, as it were, at a touch, or even by sympathy, from the vibration of an adjacent string, in the manner of a wire-covered gut.

If a drop of conducting liquid (mercury) between two electrodes (carbon or iron) which, by comparison with what I have suggested, is comparatively inert, can give such wonderful results, surely vibrating strings upon a sound box like the body of a violin, or even upon a sound board, and treated in the manner described, ought to be even more favourable to long-distance communication, as the tuning or adjustment is only limited by the tension the strings can bear without breaking.

Possibly Mr. Leslie Miller, or some other gentleman engaged in the constructive work of wireless telegraph apparatus, will kindly try this method, and make known the result.

Musicus.

Electrolytic Meters.

This discussion has so far been among manufacturers only, but I hope you will not think a word from a consumer out of place. I have had no experience with electrolytic meters, and if the effect on the lights is so bad as I have heard, I have no desire to make their acquaintance. It seems to me, however, that Mr. Bastian's answer regarding destruction of records is anything but conclusive, and he seems to have concentrated his efforts on Chamberlain & Hookham's mistake about "consuming no current." I am peculiarly interested in the question of a continuous record, because some little time ago I was the victim of a meter reader's error. I found, on checking over the account, that there was a pretty large discrepancy somewhere, and on examining the meter (which, fortunately for me, was of the motor type) I came to the conclusion that the reader had confused his figures. I forget the exact entry, but it was something in the nature of 375 instead of 357. This was entered on the card (as Mr. Bastian says it would be), but how would that have helped me if I had had an electrolytic meter? As the supply company pointed out to me at the time, even if I had not noticed the mistake, it would have righted itself next quarter, but without a continuous record I should evidently have been the loser. As for checking the reading with the man, I am out all day, and have nobody at home who understands the reading of meters.

Another point that has occurred to me in reading this discussion, is that a little judicious tipping might help to keep the account down, if the reader has no fear of anybody being able to find him out. But the fact that one or two days' readings would be in dispute every time the meter was refilled is quite sufficient for me. I shall strongly object if my company ever try to put an electrolytic meter in my house, and I thank Mr. Bastian for his frank confession.

Consumer.

Re Fulham Baths Fatality.

I have read with deep interest most of the correspondence which has appeared in the Electrical Review on the above subject, and was also interested in the paper by Mr. L. Falconar which appears in your last issue. Now, although these gentlemen have endeavoured to show how electric light wiring should be done, I have not seen anything pointing to a tangible way of ensuring that fire office rules are carried out in a proper manner. Mr. Justus Eck states in his letter that rules may be accidentally broken without anyone being the wiser. I will go one further, and say that fire rules are not only accidentally, but deliberately, broken in some cases by so-called wiremen, and not only by the men themselves, but if not with the consent, at least with the knowledge, of their employers, who tell them to throw it in. I may say that I have seen work that has been thrown in with a vengeance, and this is most unfair and unjust to those firms who pride themselves on doing things well. Now, Sir, it is with your permission and through your valuable journal that I suggest a remedy for this evil so as to prevent such lamentable accidents in the future.

That is, that all fire insurance companies should contribute so much each, according to the business they do, towards maintaining a practical electrician in every town as fire inspector, and that each firm notify him so that he could inspect the jobs as they proceed, and have his own testing set (although a good test does not always imply good work), and I am sure if this were done we should have a better tone given to electrical wiring, and so prevent a great deal of scamping that is being done at the present time by certain firms. Not only this, but a practical man on the spot could deal with the special cases as they arise.

Manthy Hill.

LEGAL.

Pressland *v.* De Meray.

In the King's Bench Division of the High Court of Justice on Friday, the case of Pressland *v.* De Meray came on for hearing before Mr. Justice Ridley and a special jury. The plaintiff, Mr. Thomas Pressland, sued the defendant, Mr. Jules de Meray, chairman of the Sir Hiram Maxim Electrical and Engineering Co., Ltd., for the recovery of damages, in respect of losses which he alleged he had suffered by purchasing shares in the company, which he, by his statement of claim, declared he was induced to buy by reason of the false representations of the defendant made within the defendant's knowledge. The representations of which the plaintiff complained were, that the company was in a flourishing condition, that it was interested in large and profitable works at Worcester, Middlesbrough, Darlington and London, where certain patents of Sir Hiram Maxim were being manufactured, and that a subsidiary company, the Hiram Maxim Lamp Co., Ltd., was formed to make the whole of the company's output of lamps; and, further, that the defendant represented that a certain number of shares of the company, on which 5s. each had been paid, were selling at a premium of 2s. per share. Believing these representations which plaintiff said were made through a Mr. Heffer, and also personally by the defendant, Mr. Pressland paid to the defendant, in August, 1901, £1,758 17s., for 5,000 5s. paid-up shares, and had since paid £500 for calls on those shares, and was liable for further calls amounting to £3,250. Plaintiff also alleged that the defendant fraudulently concealed the fact that the company had overdrawn its account at its bank to the extent of £5,000, and that instead of being a "flourishing concern," the company was actually working at a loss. The defendant denied that he had made any representations either by himself or through any other person, and that the plaintiff was not induced to purchase shares in the company by any representation made by the defendant, but acted on his own judgment, and purchased the shares with the object of qualifying for a seat on the board of directors, to which he was elected in August, 1901, and on which he acted till March, 1902.

Mr. Witt, K.C., and Mr. Bremner appeared for the plaintiff, and Sir Edward Clarke, K.C., and Mr. Lewis Thomas for the defendant.

Mr. Witt, K.C., in opening the case for the plaintiffs, said that his client was an engineer who was familiar with the kind of work supposed to be carried on by the company, and he was introduced to the defendant by Mr. Heffer. After an interview with the defendant, plaintiff was satisfied that it would be an advantage to himself to take an interest in the company, and he agreed to give Mr. Heffer a commission of £250 if he were elected on the board of directors. The company was originally incorporated in 1899 as the Maxim Electrical and Engineering Export Co., Ltd., but in January, 1901, the name was changed and the capital was increased to £175,000. The most important representations made to the plaintiff were that the company was doing a flourishing and profitable business, and was interested in engineering works at Worcester which were making a large profit, and that a subsidiary company—the Maxim Lamp Co., Ltd.—contracted to take not less than one million lamps a year at a price which would ensure a good dividend on that branch of the work done. The plaintiff was elected to the board of directors in August, 1901, on the motion of Sir Hiram Maxim who was one of the directors, seconded by the defendant, the chairman of the board. But as the plaintiff became familiar with what was being done by the company, and saw the draft balance-sheet which was being prepared, his eyes began to open, and he found that the company was actually worked at a heavy

loss upon its lamp trade, as the company was supplying lamps at 7d. and 8d. each, which cost 11d. to manufacture, and that the interest they had in engineering works at Worcester, Middlesbrough and Darlington was only an agency interest in Messrs. J. Pease & Co., of which the defendant was also a director, and that there was no profit therefrom. The balance-sheet, in fact, showed a loss of nearly £5,000 on the first year's working.

Plaintiff was called and gave evidence in support of the opening statement of his counsel. He said he tried to get the shares from defendant at par, but defendant said he could not part with them at less than 2s. premium, and that considering the profitable business the company was doing, the shares were certain to go higher.

COUNSEL read a contract between the Hiram Maxim Co. and the defendant, which showed that the price to be paid by the subsidiary company was 7d. to 8d. per lamp, and a report was read from the manager of the Sir Hiram Maxim Engineering Works, showing that the cost of manufacturing the lamps was 11d. each, but he said that by introducing improvements he could bring the cost down to 7d. or 8d., or perhaps 6d.

Cross-examined by Sir EDWARD CLARKE, WITNESS said he never tried to sell his shares for six months prior to February last. He and the defendant were the most active members in the business. It was arranged that he should be paid the 2s. per share he had paid defendant, and that he should receive £200 a year as director. He was prepared to pay £250 for the purpose of being made a director of the company.

The further hearing was adjourned.

The hearing of the case was resumed on Monday.

Mr. ALBERT EDWARD HOLE, clerk to the Registrar of Joint Stock Companies at Somerset House, produced a file, from which it appeared that J. F. Pease & Co., Ltd., was incorporated in January, 1899, with a capital of £250,000. The annual return of shareholders showed that the first entry made of the Maxim Co. holding any shares was in June, 1902, the number being 1,500. The witness also produced the file in regard to the Maxim Electrical Engineering Export Co., which was incorporated with a capital of £100,000. On February 14th this was increased.

Cross-examined by Sir EDWARD CLARKE, WITNESS said that Messrs. E. and J. F. Pease held a total of 35,600 shares in Pease's, and that the defendant and another director of the Maxim Co. held a total of 27,288 shares in Pease's.

Mr. E. Peterson, a solicitor, Mr. Frank J. Satchwell, an engineer, Mr. Victor Howard Bowles, accountant, of Hiram Maxim, Ltd., and Mr. Frederick Stokes, managing director of the London and Yorkshire Trust, also gave evidence in support of the plaintiff's case.

Sir E. CLARKE, in opening the case for the defence, pointed out that the plaintiff, from the beginning of August, 1901, when he came into the company, until the end of January, 1902, never suggested that there had been any misrepresentation on the part of the defendant further than that whilst the defendant was away from London for six weeks, the plaintiff took the position of managing director of the defendant's company, and did not attack the defendant. He never attacked the defendant until the month of April, when, amongst other allegations, plaintiff complained that defendant had misrepresented that the Maxim Co., Ltd., had allied works at Darlington, Worcester, and Middlesbrough. They had it in evidence that the Maxim's and Pease Companies, at Darlington, were closely allied, and that there sat on the Maxim Co.'s board two of the Messrs. Pease, and on the Darlington, Worcester and Middlesbrough board of directors there sat two of the directors of the Maxim Co., one of whom was the defendant. As a matter of fact, 93,000 shares of Pease were held by four gentlemen who were directors of Maxim's. It would have been exceedingly stupid for the defendant to have made the statements imputed to him. What he told the plaintiff was the truth, and in the presence of Mr. Pressland's solicitor the fullest investigations were made. Defendant certainly said that they had relations with Pease & Co., but he never made the statement that large profits were being made.

DEFENDANT afterwards gave evidence, justifying his statements to the plaintiff.

The hearing was adjourned.

The hearing of this action was concluded on Tuesday.

Mr. DE MERAY, the defendant, further cross-examined, said he had no knowledge of the actual cost of the lamps, but he said to plaintiff that with the million contract it was a profitable business. If they had turned out the million lamps there would not have been a large loss. If they had turned out a million lamps, they would have done it at a cost of 5d.

Re-examined, WITNESS said plaintiff made no complaint while he was a director.

Mr. ALFRED WILLIAM HILL, manager of the lamp department of the defendant company, gave evidence as to the manufacture of the lamps, which he said were the best finished and the best in the market at the present time. He also said that on the instructions of the defendant he showed plaintiff all over the factory when he became a director. Witness was with the Edison-Swan Co. for 20 years.

Mr. HOWARD T. WRIGHT, the manager, and Mr. JOHN WHEATLEY, the secretary of the company, spoke to giving the plaintiff all the information he desired about the company before he became a director.

At the close of the evidence the JUDGE said he did not know where they were in this case. As to some of the allegations, there was no evidence to be left with the jury. He should not leave to the jury the question of whether there was an interest in Messrs. Pease's. It was obvious that there was such an interest, and there was no evidence of misrepresentation in regard to this and other matters. He should ask the jury whether they thought the plaintiff was misled by the other matters in the slightest degree, and should give them a general charge as to the nature of the evidence required in this matter.

COUNSEL having addressed the jury, his LORDSHIP summed up, and told the jury that there was no evidence that the statements that the company had an interest in Pease & Co, or that there was a contract for the production of a million lamps was incorrect.

The jury, after a lengthy deliberation, returned a verdict for the plaintiff for the full amount claimed.

The JUDGE: What is that amount?

Mr. WITT: £5,500. I ask for judgment.

The JUDGE: Yes.

Mr. STEWART, on behalf of defendant's counsel, asked for a stay of execution on the ground that the verdict was against the weight of evidence.

The JUDGE: I think it is. It is my opinion it is against the weight of evidence.

A stay of execution, with a view to an appeal by defendant, was granted.

ROSLING & FYNN, LTD., *v.* THE LAW GUARANTEE SOCIETY AND OTHERS.

IN the Chancery Division last Friday, before Mr. Justice Buckley, Mr. Astbury, K.C., moved on behalf of the plaintiffs, who carry on business as electrical engineers at Bradford, for an interim injunction to restrain the defendant Society from carrying out a contract with three other defendants, Messrs. Rhodes, Halford and Fielding, for the sale to them of the plaintiff company's undertaking and assets. Learned counsel stated that the Law Society were the trustees for the debenture-holders under a deed of 1902. There was a clause in the debenture deed which had come into operation and whereby the debentures had become payable, and the Society were entitled to go into possession and appoint a Receiver. They did, in fact, go into possession at the end of last year. The debentures covered the whole of the assets, and the amount due for principal, interest and costs amounted to £10,155. The company went into liquidation shortly before the happening of the events relevant to this action, and a Mr. Gray was appointed liquidator in a voluntary liquidation. The company had a number of other creditors, and the liquidator almost immediately advertised the business of the company for sale, as was his duty. He got into communication with a large number of prospective purchasers, including the three defendants, Rhodes, Fielding and Halford. They had rebuilt their premises at a cost of something like £27,000, and in that state of things it appeared that early in January of this year, the liquidator ascertained that the Law Society proposed to sell by private treaty. He was of opinion that the premises were worth considerably more than the sum for which the Society proposed to sell, and that, having regard to the extraordinary hurry in which the Society had rushed things, the sale would not obtain the approval of the Court. He must admit that the liquidator had received every assistance from the defendant Society with regard to information, but it was brought to their notice that there were other offers. Hearing that the sale was about to be carried through, the liquidator had an interview with a Mr. Ronald, who acted for the Society on the 9th. No contract had been signed then. At that time the liquidator had in his pocket an offer for £11,000, but there was another offer from a substantial person to redeem the whole of the principal, interest and costs. Broadly, the point was that the Society had no right to carry out the sale when they knew that other offers were pending.

The hearing of this motion was resumed by Mr. Justice Buckley on Saturday.

Mr. ASTBURY continuing, said that the evidence for the plaintiff went to show that prior to the signing of the contract, Mr. Gray went to London with an offer in his pocket for £11,000. This only had the effect of the Society insisting upon the price to be paid by Rhodes and his partners being increased to £11,000. The liquidator had, however, obtained other offers, and at the time of the signing of the contract, there was a gentleman in another room who was prepared to complete at an increased price, but Mr. Roland for the Society declined to see him. Mr. Gray had provided himself with a cheque for £1,100, being 10 per cent. deposit of the proposed purchase price. Mr. Roland declined to accept a cheque, and declined to wait until the banks opened in the morning to enable it to be cashed. Though not in evidence, there were as a fact offers of as much as £16,000 for the property. It was very valuable, and there was a contest as to who should get it. The property only got into the hands of the Society at the end of last year, and they had taken no steps to get any other purchaser than Rhodes & Co. He submitted that the Court would not assist a mortgagee who was insisting upon selling to one person where the mortgagor was claiming to redeem, and another purchaser desired to buy the property for a larger sum. The Society, though no doubt they had a right to sell, could not insist upon selling to a particular purchaser at a particular price when the evidence was that the assets of the company were worth a much larger sum. This he submitted could not be said to be a *bonâ fide* exercise of their discretion.

Mr. BUCKMASTER, for the Society, submitted that the sale could not in any sense be described as improper. Any imputation of improper conduct should be withdrawn. All the Society wanted was their money. Their only desire had been to accept as a purchaser the person who would give the best price. At the time the offer by Rhodes was accepted, no better offer was in existence.

Mr. Justice BUCKLEY asked whether the liquidator was prepared to pay £10,500 into Court at once.

Mr. ASTBURY: Certainly.

Mr. TERRELL, for the purchasers, contended that no ground had been made out for setting aside this contract. The Society had power to sell, and in order to set aside a contract for sale by them it must be shown that it was for such a gross undervalue as to amount to fraud. No such case as that was ever suggested here. The remedy of the mortgagor, if any, was in damages, and not by having the sale set aside. It could not be said that these purchasers were to lose their bargain because the Law Guarantee Society had done something which would make the Society liable in damages.

The further hearing was adjourned.

The hearing of this case was concluded on Wednesday.

Mr. Justice BUCKLEY, in giving judgment, said the action was brought by the liquidator of the company, who was the mortgagor against the Society, who were trustees of a debenture deed dated February, 1902, and against Messrs. Rhodes, Halford and Fielding (Rhodes Electrical Manufacturing Co.), who were purchasers from the Society as mortgagees. An interim injunction was asked for to restrain the carrying out of the proposed sale. The facts of the case extended over a very short period of time—from January 2nd to January 9th. On January 2nd Mr. Gray was appointed liquidator in a voluntary winding-up, the debenture trustees having previously taken the property comprised in their security. They were proposing to sell, as they had a perfect right to do, and on January 7th Mr. Ronald, who was for this purpose the Society, wrote to the Society that he had an offer for the purchase of the property. Correspondence passed between the parties, including a telegram from Mr. Reeve, a solicitor, of Huddersfield, making an offer on behalf of Mr. Crawshaw. This was material, as showing that the Law Society knew that there were other offers in contemplation. At a meeting on the 9th in London, at which the purchasers were also present, Mr. Gray put forward an offer by Ackroyd for £11,000, not with the intention of buying on behalf of Ackroyd, for at this time he was proposing to redeem. Reeve and Crawshaw were in an adjoining room, and there was no doubt that Ronald was acquainted of their presence, and that they had come with an offer for the property. That Gray's offer to redeem was *bonâ fide* there could be no doubt, because he attended next morning with the money in notes when it was refused. Under these circumstances he (the learned judge) had to consider whether the mortgagees had done their duty to the mortgagors. The mortgagee was not in the position of a trustee, but at the same time he owed a duty to the mortgagor, and that duty was to take reasonable precautions to obtain a proper price. Looking at the offer that Crawshaw was minded to make, he did not think they had in this case obtained an offer for a proper price. The plaintiff was therefore entitled to the injunction asked for.

On behalf of the plaintiff, it was suggested that the motion should be treated as the trial of the action, but this Mr. Terrell declined to assent to, and intimated his intention of carrying the question to the Court of Appeal.

THE KING *v.* THE MAYOR OF DOVER.

IN the King's Bench Division of the High Court of Justice on Tuesday, this case came before the Lord Chief Justice, Mr. Justice Wills and Mr. Justice Channell, sitting as a Provisional Court.

Mr. C. MUNRO moved for a rule *nisi*, calling upon the Mayor of Dover to show cause why a writ of mandamus should not issue commanding him to hold a poll in regard to the electric lighting Bill of the Corporation of that place, which will come before Parliament in the approaching session. The learned counsel said he moved upon the affidavit of Mr. John Bradley, a property owner and ratepayer in the borough, who stated that the Corporation were proposing to borrow the sum of £105,000 in order to purchase some local electric light works. The Borough of Dover was now supplied with electric light by a private company, and the Corporation now proposed to buy it out. On January 6th a meeting of the ratepayers was held to consider the matter, and a large number of ratepayers attended for the purpose of voting against the proposal of the Corporation. Amongst others, Mr. John Bradley was present, and spoke against the acquisition of this property. Mr. Bradley was about to claim a poll, but before he could rise to do so, a gentleman present, who was an official of the local gas company, rose, and he claimed a poll in his capacity of a ratepayer. The Mayor accepted the demand, and thereupon Mr. Bradley got up and said he seconded it, if it was necessary to do so. The town clerk pointed out that it was not necessary to second the demand, and said there must be a poll, and the Mayor said the same thing. Afterwards the gentleman who demanded it, although he did so as a ratepayer acting in the interest of the Gas Company, obtained from the Corporation some half-a-dozen clauses in favour of his company. He thereupon withdrew his application for a poll; but Mr. Bradley pointed out that, as one of the parties who had demanded one, he should require one to be held. The Town Clerk had written a letter stating that if he could hold a poll he would do so, but it had not been held. The learned counsel contended that if a poll was demanded it must be held.

The LORD CHIEF JUSTICE: Are there any provisions for withdrawing a poll after it has been demanded?

Mr. COURTHOPE MUNRO replied in the negative.

The Court, after further discussion, granted the rule asked for.

KYD *v.* CHARING CROSS AND STRAND ELECTRICITY SUPPLY ASSOCIATION.

THIS case, which was fully reported last week, again came before the Westminster County Court on Wednesday, when Mr. Edge, sitting as deputy for Judge Woodfall, read his Honour's judgment, in which he stated that he saw no reason for not giving effect to the verdict of the jury. Judgment was therefore entered for the plaintiff for £150, with costs.

Mr. LONGSTAFFE, for the defendants, applied for a new trial, and the application was refused.

BUSINESS NOTES.

Electrical Wares Exported.

WEEK ENDING JAN. 28TH, 1902.		WEEK ENDING JAN. 27TH, 1903.	
Alexandria	Value £78	Alexandria	Value £16
Beira	464	Amsterdam	234
Brisbane	453	Auckland	252
Calcutta	2,050	Calcutta	201
Cape Town	2,897	Cape Town. Teleg. mat.	1,102
Channel Islands	10	Colombo. Teleg. wire	596
Colombo. Teleg. mat.	186	Copenhagen. Teleg. wire	54
Copenhagen	13	Durban	766
" Teleg. wire	79	" Teleg. mat.	5,229
Demerara	47	East London	785
Durban	1,400	Gibraltar	168
East London	10	" Teleg. mat.	21
Gothenburg	25	Hamburg	299
Grenada. Teleg. mat.	40	" Teleg. mat.	100
Hamburg	51	Hiogo	79
Hong Kong	742	Hobart	64
" Teleg. wire	68	Malte	80
Lyttleton	50	New York	15
Melbourne	630	North Atlantic. Teleg. cable	20,000
" Teleg. wire	2,281	Perth	68
Port Elizabeth	1,093	Port Elizabeth	171
Rangoon	17	Rio Grande do Sul	70
Shanghai	220	Sydney	204
Singapore. Teleg. mat.	99	Vera Cruz	191
Sydney	1,674	Wellington	230
Wellington	39		
Yokohama	466		
Total	£15,132	Total	£30,945

Foreign Goods Transhipped.

Cape Town. Elec. mat. Value £852

Motor-Car Show.—The Stanley Automobile Exhibition, which closed at Earl's Court on Saturday last, January 24th, comprised a very fine collection of these vehicles; but they were, of course, mainly worked by power other than electrical. Indeed, among the whole of the exhibits in the Ducal Hall and the Queen's Palace there were only two or three which included electrically-operated automobiles, though many of the stands showed convenient petrol motor cycles and vehicles suitable for the use of borough electrical engineers and others who have on occasion to cover a large ground as speedily as possible. The use of motor-cars has been frequently recommended for municipal officials, for their own purposes and for the purpose of repair operations, and these shows of what is being done in the industry are now so very frequent and so representative that there is ample opportunity for inspecting a goodly variety of styles from which to make a selection. Messrs. Shippey Bros. were in evidence at the Stanley Show with their Canadian electrical carriages, including a doctor's phaeton and family brougham, and they also exhibited samples of their Ideal batteries and Still motors and equipments with which the vehicles are supplied. The Burlington Carriage Co., of Oxford Street, showed among their other Dietrich cars, a 4-H.P. electric park phaeton which they supply in two types, A for a 35-mile range of battery charge, and type B for a 50-mile range. The Electric Carriage Manufacturing Co., of 34, Victoria Street, showed an electric landaulet on the Mildé system, for seating two. Their elegant electric coupé has a differential electric Mildé motor with a direct drive on the wheels of the carriage. The company has issued a neat pamphlet of its various types of electromobiles, including its self-generating landaulets, omnibus-brakes and delivery vans, and copies of this may be obtained on application.

"Commercial Intelligence."—Mr. Henry Sell, though at one time prominently associated with the Commercial Intelligence Bureau, Ltd., of Eastcheap, wishes it to be understood that neither he nor his journal *Commercial Intelligence* is now connected with that bureau.

Supper.—On January 19th the staff and friends of the Isle of Thanet Electric Tramways and Lighting Co., Ltd., were entertained to supper at the invitation of Mr. R. Humphries, resident engineer and manager.

The "Shuck" Meter.—The Spanish Government has approved the use in Spain of the electricity meter of the Sociedad General Espanola de Electricidad, and known as the "Shuck."

B.T.H. Co.—In our article on "The Dynamo Business at the Close of 1902" (p. 85, January 16th), we remarked that the B.T.H. Co. "will also presently be in a position to manufacture at Rugby *all* that they require." Our readers are, of course, aware that the emphasis should be laid on the word "all," for as we showed when we described the Rugby works recently, the company has been manufacturing there for some time past. The factory is in full swing, employing over 800 hands, and the manufacturing facilities are being extended to meet the growing demand.

American Electrical Exports.—The value of the electrical plant and apparatus exported from the United States during November last is returned at £142,432, as compared with only £110,534 in the corresponding month of 1901. The largest individual customer was Great Britain, which was responsible for £33,669 of the total.

Combined Petrol Motor and Dynamo.—The Wolseley Tool and Motor Car Co., of Adderley Park, Birmingham, are introducing a combined 4-H.P. petrol motor and dynamo for electric lighting purposes. Combinations of this kind are largely used in France, and we are glad to see that attention is now being given to them in this country.

Bankruptcy Proceedings.—A meeting of the creditors of John Fredk. Worthington and Gerald Nuttall, trading in copartnership under the style of J. Worthington & Co., at Foundry Works, Foundry Street, Hanley, as electrical engineers, was held at Stoke on Friday last. Mr. T. Bullock (official receiver), presided. The statement of affairs filed by the debtors, placed the gross liabilities at £1,319, and the net assets £1,810. Debtors alleged losses on contracts as the cause of their failure. The Official Receiver said the receiving order was made as far back as August 11th on a creditor's petition, the act of bankruptcy being the execution of a deed of assignment by the debtor. Notice of appeal against the receiving order was made, and an order to stay proceedings in this court was made on August 28th. The appeal was heard on December 15th, and dismissed. The statement of affairs which had been lodged, instead of showing a deficiency, as was usually the case, showed a surplus of £537 18s. 8d., therefore, if the debtors' statement was correct, the creditors would not only get 20s. in the £, but the debtors would have a substantial sum for themselves. The creditors numbered 74, and the Official Receiver asked if there was any offer to be made. If the estate was worth the sum estimated, there was no reason why the debtors should be adjudged bankrupt. The debtors' solicitors both said they had no offer to make. The Official Receiver said the absence of any offer rather threw doubt on the accuracy of the statement. A creditor said he did not think the estate would realise the amount put down, and it was mentioned that at a meeting which had been held, it was suggested that 10s. in the £ would be the sum it would realise. The sum of £1,200 was now mentioned. The debtors were adjudged bankrupt by resolution, and Mr. C. T. Appleby, chartered accountant, Birmingham, was appointed as trustee. The committee of inspection was appointed as follows:—Messrs. S. Gratrix, Jun., & Bros., Ltd., Manchester; Messrs. W. T. Glover and Co., Ltd., Manchester; and Mr. C. N. Newton, of Newton Bros., Derby. As regards the separate estates, Mr. Bullock said nothing would be derived from Mr. Nuttall's private estate, but it would appear that there would be about £170 from Mr. Worthington's private estate to come for the benefit of the creditors.

Football.—A football match was played on Saturday last at Blackburn between the N.T. Co.'s technical staff of Blackburn and Burnley. The Burnley men proved the victors by 5 goals to 2. Later the teams partook of a spread, and towards 10 p.m. a most enjoyable social gathering ended.

Travelling Electric Lights.—Messrs. Thos. Laurie & Co., electricians, Falkirk, have just fitted up the works of the London Scottish Foundry, Ltd., London, with the electric light on their patented travelling electric light system. This firm is also busy with extensions at the Saracen Foundry, Glasgow (Messrs. Walter McFarlane & Co.).

Delagoa Bay.—A prospectus has been placed before the public this week by the Delagoa Bay Development Corporation, Ltd., inviting applications for 54,000 £5 shares for purchasing and carrying on certain undertakings in Lourenço Marques and elsewhere. The telephone system of Lourenço Marques, and 7 miles of electric tramways are parts of the company's schemes.

Books Received.—"Annual Report of the Smithsonian Institution for 1901." Washington: Smithsonian Institution. 1902.

"Subject List of Works on General Science, Physics, Sound, Music, Light, Microscopy and Philosophical Instruments in the Library of the Patent Office." London: The Patent Office. 1902. 6d.

"Bulletin of the United States Fish Commission." Vol. xx., parts I. and II. Washington: The U.S. Commission of Fish and Fisheries. 1902.

"Hazell's Annual for 1903." Edited by W. Palmer. London: Hazell, Watson & Viney, Ltd. 1903.

"Design of Dynamos." By S. P. Thompson. London: E. & F. N. Spon, Ltd. 1903. 12s. net.

"The Slide Rule." By R. G. Blaine. London: E. & F. N. Spon, Ltd. 1903. 2s. 6d.

"Kalender fur Elektrochemiker fur 1903." By Dr. A. Neuburger. Berlin: M. Krayn. Mk. 4.

"Electricity as Applied to Mining." By A. Lupton, G. D. Aspinall Parr, and H. Perkin. London: Crosby Lockwood and Son. 1903. 9s. net.

The Crystal Palace Motor-Car Show.—At this exhibition, which opens to-day, the Electromobile Co., Ltd., of London, has on view a new "1903" type of electric carriage, whose main features are its straight chassis and underslung interchangeable battery. In order to reduce the cost of construction, the company has evolved one type of chassis suitable for all of its town vehicles. No doubt all electrical visitors to the show will make a point of seeing this exhibit.

Belliss Engine Contracts.—The following sub-contracts have been let to Messrs. Belliss & Morcom:—By the General Electric Co. (1900), Witton, three 110-H.P. engines for direct coupling to G.E.C. dynamos for the Central South African Railways; by the Allgemeine Elektricitäts Gesellschaft, two 1,000-H.P. engines for direct coupling to A.E.G. dynamos at Sunderland; by the Electric Construction Co., Ltd., one 370-H.P. engine for direct coupling to E.C.C. dynamo for the Blackheath and Greenwich District Electric Light Co.; by the British Westinghouse Co., Ltd., three 300-H.P. engines for direct coupling to Westinghouse dynamos for Western Australia. Messrs. Belliss & Morcom have also received a contract from the Admiralty for one 90-H.P. engine coupled direct to a Siemens dynamo, mounted on a trolley carriage by Messrs. John Fowler & Co., Ltd., for the Chatham Naval Barracks; and for two 300-H.P. engines direct coupled to Lancashire Dynamo and Motor Co.'s dynamos for the Lourenço Marques Tramway power station.

Catalogues.—An illustrated pamphlet of electric cranes of various types, stocked by MESSRS. HERBERT MORRIS & BASTERT, LTD., of Loughborough, has been sent to us.

MESSRS. ERNEST SCOTT & MOUNTAIN, LTD., have sent us a number of their illustrated lists describing some recent mining plants which have been installed by them. No. 29 details the generating motor and pumping installation of the Ocean Coal Co. at Treorchy, R.S.O.; No. 30, plant of somewhat similar kind supplied to the Frodingham Iron and Steel Co.: No. 42, an electric pumping plant installed for the Ashington Coal Co., in Northumberland; No. 43 gives full information relating to a larger undertaking carried out for the Port Talbot Iron and Steel Co., in South Wales, including a 550-I.H.P. engine driving two 150-KW. continuous-current generators by ropes, and a large number of motors for various driving purposes; and No. 46, particularising their pumping machinery put in at the South Skelton mines of the Clay Lane Iron Co. Messrs. Scott & Mountain have just secured an order from the South Wales Anthracite Coal Co. for a complete electric pumping and hauling plant. The installation will comprise an 165 I.H.P. horizontal engine of the long-stroke type, a Scott & Mountain four-pole generator to give an output of 75,000 watts, the E.M.F. being 500 volts and the speed approximately 650 revolutions per minute. The motors to be supplied include one 42-H.P. four-pole motor for operating a main rope haulage gear to draw trucks at a speed of about five miles per hour, the inclination against the load being 1 in 7. There will be a S. & M. three-throw mining pump, fitted with rams 7 in. diameter by 9 in. stroke, to deliver 150 gallons per minute, against a head of 340 ft. This pump will be driven by belt from a four-pole motor, constructed to give out 25 H.P. (450 volts). A centrifugal pump is to be supplied to deliver 40 gallons per minute, against a head of 50 ft., driven direct by an 8 H.P. enclosed motor, which is to be mounted upon an extension of the pump bedplate; also a vertical three-throw ram pump to deliver 20 gallons per minute, against a head of 100 ft. This pump will be driven through machine-cut spur gear by a 3 H.P. enclosed type motor, and the pump and motor will be mounted together on a trolley bedplate, complete with wheels for easy transit in the pit. There will also be a portable two-throw ram pump, to deliver 40 gallons per minute, against a head of 100 ft., driven by a 3 H.P. enclosed motor. The motor will drive the pump by belting, and the pump and motor will be mounted upon a combination bedplate, fitted with wheels for easy transport in the pit. Switchboard, and stopping and starting devices, are included in the contract.

Of all the wall calendars which have come to our hands this year—and they have been far more numerous than usual—the most artistic is that of the CHRISTENSEN ENGINEERING CO., of Milwaukee. Its most attractive feature is a beautifully coloured copy of Tyler's painting, "Moonlight Sail," let in above the monthly calendar slips.

A useful catalogue of porcelain goods, with a large number of outline drawings of all kinds of insulators and switch parts, also prices of same, has come to hand from ROBERT HANKE'S NACHFOLGER. The present proprietor of these factories, at Ladowitz, in Bohemia, took them over in 1896, and the business is now divided into three separate departments—(1) ivory porcelain, (2) majolika, (3) electro-technical.

An illustrated catalogue has been issued by MESSRS. G. STRAUS AND CO., LTD., giving many illustrations and diagrams of the "Fafnir" motor engines, speed gears, axles and accessories, as manufactured by the Aix-la-Chapelle Steel Works, for whom they act as sole agents for England and the Colonies. The engines listed range from $1\frac{3}{4}$ H.P. to 16 H.P., and the works are at present engaged upon a four-cylinder 20-H.P. engine, which they hope to be able to place upon the market in a very short time. The catalogue gives dimensions, and contains some information to enable the car-builder to put the Aix-la-Chapelle goods in the most advantageous working order to build an easy car. Motor engines for stationary use are also included, a petrol motor engine being shown coupled to a dynamo for electric house-lighting plant. We are informed that at

the Crystal Palace automobile show, which opens to-day and closes on February 7th, Messrs. Straus will have specimens of all these goods on exhibition.

The General Electric Co. (1900), Ltd., has issued a catalogue of some special lines of electric light fixtures which are not included in its current list, and which are to be cleared out quickly at low prices.

The Birmingham Electrical Fittings Co. has sent us a set of its sheets particularising and pricing its Clip type fuseboards, fusebridges, Johnson's safety distribution board, H.V. main switches, cut-outs and ceiling roses. The lists are bound up in such a manner as to allow of the easy addition of any other lists that the company may issue later. Copies of the catalogue will be sent on application.

A handy "Daily Memory Jogger," to keep on the desk for jotting down appointments, has been sent out by Messrs. Fleming, Birkby & Goodall, Ltd., of Halifax. There is one tear-off sheet for each day.

Circular No. 1,027 of the General Electric Co. (1900) describes several of their small specialities, including the new tandem "Adelphi" switch, cut-out and switch for tramway lighting circuits, "Stanley" electric bell, &c.

Messrs. Stegmann & Co., of Clapham Junction, S.W., have issued a wall card calendar of striking design and colouring.

The Stirling Boiler Co., of U.S.A. (Deansgate Arcade, Manchester), have sent us one of their handy little desk calendars with changing days and months.

From Messrs. H. G. Skelton & Co., of Finsbury Pavement, we have received a catalogue giving details respecting the advantages and uses of their Differdange rolled steel beams with broad flanges.

A small reprint circular relating to the roll-drop commutator segments has come to hand from the Forest City Electric Co., of Manchester.

Messrs. Mather & Platt have issued in their usual excellent style a new list of their multipolar dynamos. The frontispiece shows one of the 750-kw. steam sets at the Salford station.

Messrs. Jackson Bros., electrical engineers, of Plaistow, have sent us a wall calendar for 1903.

We have received a calendar from the Lunken Valve Co., of 35, Great Dover Street, S.E., which should prove useful in large offices, &c., on account of its particularly bold figuring.

Trade Announcement.—Messrs. Home & Rowland, of Troughton Road, Charlton, S.E., are circularising the trade respecting their arrangements for undertaking repairs to dynamos, motors, polyphase and all classes of electrical machinery and apparatus. They make a speciality of rewindings to suit altered voltage, frequency, and other conditions.

ELECTRIC LIGHT AND POWER NOTES.

Antwerp.—In consideration of a concession granted by the Antwerp Communal Council to the Antwerp Electric Tramways Co. to run an overhead system through the principal streets of the city, the tramway company has agreed to light the main arteries of the town with electricity. There will be in all 150 arc lamps of 20 amperes each.

Asylum Lighting.—The Visitors to the Lindsey, Holland, Grimsby and Lincoln Asylum on January 22nd decided to have the electric light installed at the Asylum at Bracebridge Heath. The estimated cost of the plant is £4,500, and the annual cost of working and repaying principal and interest £683 5s. For this 1,100 lamps will be supplied. Last year the gas bill amounted to £593.

Barnstaple.—The new electric lighting works is situated opposite the entrance to the Cattle Market. The foundations have had to be of great strength in order to guard against any encroachment by the River Taw. The demand made on the works will, temporarily, be comparatively limited, but provision in the way of machinery has been made for lighting the whole of the borough. There are three single-acting three-crank compound engines, each of 220 h.p., coupled direct to dynamos of 125 kw. each. The switchboard consists of an enamelled slate slab on a steel frame. A travelling crane, capable of lifting 5 tons, has been provided. There are 230 accumulators, which will be able to light the town for over an hour in an emergency. There are three water-tube boilers, each of 1,570 sq. ft. heating surface, and an economiser of 120 pipes, superheaters being provided, by means of which a temperature of 500° F. can be attained. The boilers can be fed either with a Hall's compound pump or with injectors. The compulsory area will be supplied with electricity by means of dialite cables laid underneath the pavements in wood troughing run in solid bitumen. Light is to be furnished by eight arc lamps, each of 2,000 c.p., and each bracket will have two Nernst lamps. The Council's consulting engineer is Mr. W. H. Trentham, of Westminster. The sum of £21,600 was borrowed for the carrying-out of the scheme, and the contracts were within the original estimates.

Bath.—Next Tuesday the local authority will consider the E.L. Committee's recommendation to apply for power to borrow £50,000, as follows:—For carrying out Mr. Manville's recommendations, £43,226; for excess of expenditure upon capital, £1,032; for extensions of mains during the next three years, £5,742.

Birmingham.—The Corporation Electric Supply Committee recommends the T.C. to apply for loans of £11,500 for additions to the plant, &c.; £3,000 for services, &c.; and £2,000 for meters.

Brussels.—Last week we announced that the Brussels Communal Council had decided to construct a new central power station, and to organise a prize competition for the plans of the proposed station. We understand, however, that at the last moment an offer has been made by the Brussels Electric Tramways Co. to supply the necessary electricity for lighting the town, at a price considerably lower than that which would be possible in the event of the Communal authorities laying down new plant. The tramway company's new stations are capable of furnishing all the power necessary, and in virtue of the convention of 1899, these stations will become the property of the town in 1945. The Lighting Committee has promised to carefully consider the matter.

Buckinghamshire.—The County Council has lodged with the B. of T. objections against the Uxbridge and District Electric Light Co.'s application for a prov. order to supply various places in the county. The Council objects to a large area being added to the company's area of supply without any part of it being scheduled for compulsory works within a given time. This, it is urged, is unfair to other companies or local authorities. Another objection is that the character of the proposed additional area is not at the present time such as to justify the powers sought being given.

Cardiff.—During the past 12 months 25,000 new lamps have been connected, and 230 new consumers have been added. Mr. Arthus Ellis has reported that in the quarter ending December 31st, half a million units of electricity had been sold, which equalled half the sale during the previous 12 months. The total cost of production per unit was 1½d., and this cost included the repayment of loan charges, which amounted to more than £7,000 per annum. The average price per unit for the year was 3½d.

Carnarvon.—A meeting was held on the 21st inst. to consider a scheme by Mr. Chas. H. Rees for supplying the town with electricity, providing he could get local support.

Cheltenham.—The T.C. is seeking powers to trade in electric apparatus for hire, including electric light fittings, &c., and to wire and fit up such apparatus.

Cheshire.—The T.C. has considered the Bill promoted by the North-Western Electricity and Power Gas Syndicate, and has adopted a recommendation that it should be petitioned against, with a view to excluding (except with the consent of the Corporation) the city of Chester from the powers sought by the Bill. The Bill has also been the subject of a conference between representatives of the Flintshire County Council and the local authorities of the districts which lie within the prescribed area of supply in North Wales. The scheme is favourably regarded by the great bulk of the inhabitants, and especially by small manufacturers in districts where little or no chance exists of its advantages being provided locally; and this feeling was reflected by the conference at Mold. As regards Cheshire it was stated there was no intention on the part of the County Council to oppose the Bill, but a petition would be presented in order to give the Council a *locus standi*, and to ensure the insertion in the Bill of protective clauses. In the end it was resolved that similar action should be taken on behalf of the Flintshire County Council, the urban and other district councils being invited to join in the petition.

Dingwall.—The T.C. has formally agreed to the introduction of the electric light.

Dover.—Owing to the unwarrantable attacks made by certain members of the T.C. on the undertaking of the Dover Electricity Supply Co., the secretary, Mr. W. J. Broad, has informed the Council that if the Corporation sees any cause to regret the bargain it has made in its contract to purchase the undertaking, the directors are willing to recommend their shareholders to abrogate the contract for sale, on being reimbursed the expense to which the company has been put by the negotiations and agreement. The T.C. has referred the matter to the Electricity Committee. The company's offer has caused astonishment to those who opposed the purchase of the undertaking.

Eccles.—The L.G.B. has sanctioned the raising of a loan of £22,115 by the T.C. for the extension of the electricity works so as to supply energy to the tramways, and the extension of cables.

Edinburgh.—The Electric Light Committee of the T.C. has recommended the acceptance of estimates for a dynamo, engine, and boilers for the McDonald Road Station in order to be in a position to supply the prospective demand of next winter. The cost is estimated at about £7,000.

Enniscorthy.—The Wexford C.C. has approved of the proposed application to the Commissioners of Public Works for a loan of £2,100 for the purchase of Kilcarbery Mills, to put down plant for the electric lighting of the Enniscorthy District Lunatic Asylum, and a loan of £4,400 for the purchase of machinery.

Falkirk.—The electric light works, which are expected to be opened next month, are situated on an extensive site in the southern portion of the burgh, sufficient ground having been acquired for future extension. The boilers, which are of the dry-back marine type, supplied by Messrs. George Sinclair & Co., Leith, generate steam

at a pressure of 165 lbs.; a feed pump by Messrs. Hall & Sons, and injectors are provided. In the engine room are three sets of high-speed engines by Messrs. Belliss & Morcom, Ltd., of 150 H.P. each, coupled to dynamos by Messrs. Mavor & Coulson, Glasgow, of 100 KW. each, and provision has been made for laying down another set. There are also two motor-generators for charging the battery, and a balancing transformer; these have been supplied by the International Engineering Co, Belgium. The switchboard has been erected by Messrs. Johnson & Phillips, London. There are two batteries of 128 cells each, supplied by the Electric Power Storage Co., London. The cables, which have been supplied by the Callender Co., London, are triple concentric, paper-insulated, and vulcanised-bitumen covered, and at present four feeders are laid in Sykes conduits. For lighting the streets there are 35 arc lamps, and each post has been fitted with two incandescent lamps for use after midnight. The arcs were supplied by Messrs. Crompton & Co., London. The feed heater is of the Joseph Wright type, and the economiser was supplied by the Clay Cross Co. The estimated cost of the undertaking, including plant, was £25,000. Mr. John McMillan is the resident electrical engineer, and Messrs. Burstall and Monkhouse, London, are the consulting engineers. The charge for lighting is 6d. per unit, and for power 2d.

Faversham.—As the Kent Electric Power Co. will not apparently be in a position to supply electricity next winter, the T.C. has decided to renew its application for sanction to a loan to carry out its prov. order, and establish electricity works.

Gillingham (Kent).—The U.D.C. has offered to supply electricity to the New Naval Hospital at 7d. per unit for the first hour per day, and 2½d. per unit afterwards, on a three years' agreement.

Glasgow.—The Clyde Trust officials have arranged to conduct a series of experiments with an electric light life-saving hook, which is the invention of a Pollokshields man named McKenna. The apparatus consists of a long pole, with a hook and an electric light at the outer end, the object of the illuminant being to locate the whereabouts of a person who may have fallen into the river in the darkness.

Hebburn.—The town will shortly be lit by electricity, the number of lamps employed being between 500 and 600 at £2 5s. each per annum. Electricity is to be supplied by the Northern Counties Electricity Co.

Kent.—The Kent Electric Power Syndicate, Ltd., has decided to withdraw its tramway Bill for the proposed Maidstone, Rochester and Gravesend Tramways, but the Chatham and District Light Railway is to be carried out.

The Syndicate has obtained the consent of the Sevenoaks, Sittingbourne and Milton authorities to its B. of T. application for those districts, and is also applying for provisional orders for Bromley, Strood, Deal, Sandwich, Walmer and Estry.

Kingston, Jamaica.—In connection with the application to the Privy Council of the West India Electric Co., Ltd., to light Kingston with electricity, the Government is now appointing a gentleman to inquire into the application.

Liverpool.—The Electric Power and Lighting Committee has framed the subjoined resolutions: "That the Council be recommended to adopt the following principle in dealing annually with any surplus profits of the Electric Supply Department: 'That until the reserve funds amount to the limit fixed by the Board of Trade of 10 per cent. on the capital expenditure of the undertaking, any sum not exceeding 1 per cent. on the capital expenditure be added to the reserve funds; two-fifths of any profits in excess of the above sum to be added to the reserve funds, and three-fifths to be used in aid of rates.'" "That the sum of £10,000 be transferred to reserve fund, £11,386 9s. 8d. to the renewal fund, and £12,029 to the general rate."

Llanelly.—After considering the Bill of the Carmarthenshire Electric Power Co. for electric lighting and traction in the county, the U.D.C. has appointed a deputation to approach the company and endeavour to secure the adoption of the whole of the Council's contract with the British Insulated Wire Co. in the Bill. The Council obtained a prov. order—the oldest in the kingdom—in 1891, and sat on it till recently. The Council had, however, entered into a contract with the British Insulated Wire Co. for electric lighting and traction in the town and in the suburbs of Pwll, Llwynhendy, and Felinfoel, and it was thought unwise to oppose the Bill, as it was stated that the Carmarthenshire Co. was formed at the instance of the British Insulated Wire Co.

London.—At the Surveyors' Institution, Westminster, the arbitration proceedings between the Metropolitan E.L. Supply Co., Ltd., and London County Council were resumed recently, the latter body having compulsorily acquired the company's Sardinia Street works and plant for the Strand improvements. The umpire was Sir John Wolfe Barry, and the arbitrators, Sir Frederick Bramwell, Bart., for the company, and Mr. Andrew Young, F.S.I., for the County Council. For the company Sir Wm. Preece estimated that a sum of £151,600 would be required for plant for the new works, at the rate of some £37 per KW., 500-KW. units being proposed. Mr. S. Z. de Ferranti approved of the prices mentioned. Mr. Stanley Peach, F.R.I.B.A., for the company, estimated the cost of buildings, exclusive of compensation for ancient lights or underpinning adjacent property, for a capacity of 4,000 KW., at £153,700. After some further discussion as to the area of land available, and the ultimate intentions of the Council in regard to the adjoining property, a proposition to sink the building 32 ft. deeper into the ground, and so avoid interference with ancient lights, was dismissed on account of the cost. Further evidence on behalf of the company was given by Mr. Wm. Lawrence, contractor, Mr. Chas. Reilly, F.R.I.B.A., and Mr. Leslie R. Vigers, F.S.I., and the inquiry was then adjourned.

STEPNEY.—Mr. Arthur Wright, consulting engineer, in a report presented to the Borough Council last week, said: "In the early stages of an electricity supply undertaking, one large consumer, provided he uses his demand for the equivalent of 365 hours per annum, is cheaper to supply than a large number of small consumers with an equivalent demand. Up to the fourth or fifth year every additional unit sold helps to reduce the average cost per unit, and obviously, therefore, the large consumer has a greater effect upon the reduction in the average cost than the smaller consumer. Further, the capital outlay on service lines and meters is proportionately less, and the amount of clerical work and accountancy work involved is also reduced. In order, therefore, to retain several large consumers whose loss at the present time would certainly involve increasing the average cost of supplying other consumers, I recommend that a discount be allowed to all consumers whose annual bill exceeds £100." It was resolved that to all consumers whose annual bill exceeds £100 in respect of any one premises a discount of 20 per cent. on the excess only over the £100 shall be paid, provided that such consumers shall have consumed and paid for at least 18 units per annum per 8 C.P. lamp or its equivalent demanded.

BERMONDSEY.—The electricity supply failed on the 7th inst. from 11.15 p.m. to 11.30 owing to a short circuit on the distributing main. The defect was found to have taken place close to one of the trees recently planted by the County Council in the Bermondsey New Road, the cables being evidently damaged by the workmen when excavating.

FULHAM.—The Electricity Committee is inviting tenders for the erection of a building to contain transformers of 600 aggregate horse-power. A power and lighting main is to be laid in Townmead Road, capable of supplying from 500 to 600 H.P., and the necessary transformers are to be obtained as required at a cost of about £4,000. Messrs. Fielding & Platt are to supply a 40-B.H.P. Bruce Peebles two-phase alternating motor, with details therefor, at £140.

HAMPSTEAD.—Statistics presented to the Lighting Committee by the engineer show that for the nine months ended at December the number of 8-C.P. lamps connected was 22,379, as compared with 19,623 in 1901; the number of consumers was 417, as compared with 384. The top load of 2,140 KW. was reached on December 15th, as against 1,810 KW. on Christmas Eve, 1901.

Longton.—The T.C. has resolved to oppose the Bill promoted by the North-West Electricity and Power Gas Co.

Ludlow.—The B. of T. has refused to consent to the Corporation selling its electric lighting prov. order to a local company for £225. The Council will have to act under the prov. order, failing which it will be revoked by the Board.

Manchester.—Prof. Kennedy has now agreed to report on the affairs of the Electricity Department. The inquiry is being conducted in private. At meetings of the City Council the present chief engineer has been held responsible for the provision of superfluous plant. On the other hand, the Electricity Committee maintains that the provision made is more than justified by present and prospective requirements. On this disputed point, and on the general administration of the department, Prof. Kennedy will deliver an impartial judgment. Those on the spot best able to judge hold that it is better to have a margin of power available, in order to cope with the demand which may arise for electrical energy in and around this great manufacturing centre. The increased demand for light and power with private consumers, together with the requirements of the tramway system, when fully developed, will, it is believed, fully balance the supply available. In the past the fault of the department has been that it has been unprepared for emergencies, and this has lost the electrical contractors and manufacturers a considerable amount of work in this country, as most of the contracts for large generators and machinery have gone abroad, owing to urgent delivery being essential. Thanks to its policy of panic, it appears that the Committee has overshot the mark. The pendulum phenomenon is a common feature of politics, but there is no place for it in the purchase of electrical machinery, and it is to be hoped that in the future Corporations endeavouring to conduct big businesses of this kind, and their advisers, will keep their heads and give their fellow-countrymen a chance.

Mexico.—The project for the supply of electrical energy to the City of Mexico, to which we recently referred, is in the hands of a number of Canadian financiers, who have obtained a liberal franchise from the Mexican Government, controlling 80,000 available water horse-power, which, it is hoped, will be fully developed in four years. The capital is $12,000,000, of which the greater part has already been subscribed.

Newton Abbot.—The U.D.C. is considering the proposed agreement between the Council and the Urban Electric Supply Co., Ltd., for lighting the public lamps with electricity, and has received a report thereon from Messrs. Handcock & Dykes, consulting engineers.

Tottenham.—At the District Council meeting last week the Electric Lighting Committee recommended that Mr. W. C. C. Hawtayne, the electrical expert engaged by the Council, should, in conjunction with the engineer, prepare an estimate of the cost of electrically lighting the High Road and 26 other streets in the parish. The report was adopted.

Northfleet.—A curious dispute has arisen relative to the lighting of the tramway depôt. The tramway company obtains power for the trams from the Gravesend Corporation, and from this the depôt, which is in Northfleet, is lighted. The U.D.C., which possesses its own prov. order, but has not yet exercised it, objects to electricity being supplied to Northfleet for lighting purposes from Gravesend. As the Council is not sure of its ground, the matter has been deferred.

Penge.—The U.D.C., having received a memorandum from the Blackheath and Greenwich Electric Light Co. explaining the intentions of the company with regard to the proposed lighting by electricity of Penge, has decided not to approve of the proposals of the company. The latter offers to supply energy at 2½d. per unit as against 3d. offered by the Lewisham Co., but the offer is accompanied by conditions which the Council cannot accept, especially in view of the more favourable terms which it hopes to get from the Beckenham U.D.C.

Perth.—The electrical engineer has proposed that the T.C. should increase its plant to the value of £3,000, to meet the increased demand for light next year, and that additional plant to the extent of £2,000 should be laid down for the supply of the tramways. The Council sent back the first proposal for a detailed report, and the second suggestion was deferred for the consideration of the Tramway Committee.

Portugal.—The *Diario del Governo* contains a decree approving a contract entered into between the Municipal Council of Cintra and the Cintra and Praia dos Maçaş Railway Co., for the electric lighting by the latter of the city of Cintra.

Rosario.—A River Plate exchange says that the Rosario Electric Co., Ltd., has applied to the Finance Minister for permission to import all its machinery, dynamos, cables, &c., duty free.

St. Helens (I. of W.).—The offer of the St. Helens Electric Light and Power Co. relating to the lighting of Seaview and Springvale was recently accepted, subject to an agreement being first approved by the Council.

Skegness.—The U.D.C. has received from a private company a proposal to provide electric lighting for the town, by leasing the Council's prov. order for a period of 42 years, the Council to have the option of purchase at the end of 21 years, and each subsequent five years. Electricity would be supplied for public lighting at £2 per annum for each lamp of 16 C.P.; to business premises at 3d. per unit, and to private houses at 2d. Fuller particulars of the scheme are to be submitted to the Council.

Somerset Electric Power Bill.—A largely attended meeting of representatives of county authorities affected by the Somerset and District Electric Power Bill was held on Thursday last at the Grand Hotel, Bristol. The Bill was discussed, and a resolution to oppose the Bill in its present form adopted.

Southend-on-Sea.—Two of the principal streets of the town, together with the Sea Front, are to be lit by electricity at an annual cost of £529 12s. 6d.

Walsall T.C.—It will be necessary during the coming year to increase the plant for next winter's load, and the committee recommends that application be made to the Local Government Board for its sanction to a loan of £14,500, in addition to the loan of £10,050, for which the Council last directed application to be made.

West Australia.—The Boulder T.C. has agreed to grant a lease for the supply of electric power in its area to the Kalgoorlie Electric Lighting and Power Corporation.

ELECTRIC TRACTION NOTES.

Bromley.—The scheme of electric tramways for Bromley, to connect with the system decided on for Beckenham, and through it with the Croydon tramways, has been dropped. The Bromley U.D.C., after a long and careful consideration of the scheme, decided to come to terms with the B.E.T. Co., and the necessary agreement was signed and sealed. Everything was apparently settled, but now the B.E.T. Co. has written to the Bromley Council to the effect that the negotiations must be considered at an end. The Council, therefore, had no alternative but to rescind the resolution they had passed, and to cancel the seal which had been attached to the agreement. In Bromley, the action of the company is very warmly criticised.

Cardiff.—At a meeting of the Corporation Tramways Committee on Friday, it was reported that the B. of T. had requested that each electric car should, within six months, be fitted with a speed indicator. The electric engineer (Mr. Ellis) pointed out that no satisfactory indicator was on the market which the B. of T. would recommend, and the public would run greater risks if the driver kept his attention on an indicator instead of keeping his eyes always straight ahead.

The Tramways Committee on 23rd inst. discussed the question of reconstructing the lines recently acquired from the Cardiff Tramway Co. The borough electrical engineer was asked to report on the cost of the work.

Croydon.—The County Council has at last decided to carry out the extension of the Croydon tramways from the present terminus in High Street, South Norwood, to the borough boundary at Penge, and the work will be proceeded with at once. The Tramways Committee recommended that Mr. E. W. Monkhouse, having had the over-sight, as engineer, of the electrification of the borough tramways, should be appointed to take charge of the work at an inclusive fee of £150, but it was pointed out that the borough electrical engineer (Mr. J. Gray Scott) could do the work, thus saving the £150, and this part of the recommendation was sent back to the Committee.

Durban.—Electric water-sprinklers were lately put on the streets of the town. The machines run on the tramway track, and water the whole of one side of the street at once, the jets having a range of about 40 ft. A single machine can do the work of at least half-a-dozen of the ordinary water carts.

Gillingham.—A letter has been received by the Gillingham Urban District Council (Chatham) from Mr. C. H. Mers, the engineer to the Chatham and District Light Railways Co., pointing out with reference to the proposed extension of their tramway service from New Brompton into Rainham, that the County Council was asking the company to keep in repair the whole of the roadway and path where the rails ran. This, he pointed out, was a more severe condition than was imposed by the Act of 1870, and would entail such a heavy expense on the company, that they might have to drop the whole scheme. The company were now endeavouring to influence the County Council to reconsider its decision, and in this they were supported by the local authorities. They would, therefore, be glad if the Gillingham Council would pass a resolution approving the scheme on the ground that it would be beneficial to the district. It was decided that the Council having given consent to the extension scheme, could go no farther.

Glasgow.—In a letter to the *Times*, Mr. D. M. Stevenson criticises correspondence which has recently occurred on the subject of the Glasgow tramways accounts. Referring to a statement which appeared in the *Glasgow Herald* that increased working expenses and decreased receipts amounted to £29,000 for 4½ months ending October 18th last, he supplies the following figures:—For the period from June 1st to Saturday last, 17th inst., say 7½ months:—Car-miles run, 1903, 8,572,836; car-miles run, 1902, 7,916,450; increase for 1903, 656,386. Drawings to January 17th, 1903, £404,278 0s. 3d.; drawings to January 18th, 1902, £402,966 13s. 4d.; increase for 1903, £1,311 6s. 11d. Passengers carried, 1903, 110,217,928; passengers carried, 1902, 107,327,521; increase for 1903, 2,890,407; thus verifying a previous forecast as to the financial success of the undertaking compared with previous years. He also mentions that the revenue for 7½ months averages 11·32d. per car-mile, as compared with 11·66d. in the previous year, which, taking into account the recent reductions in fares (some 25 per cent.), is considered eminently satisfactory. The car mileage is at the rate of 13,000,000 per annum, and after making allowance for working expenses, interest, sinking fund, depreciation (over £100,000), payment to the common good, amounting to 9·58d. per car-mile, an available profit margin of nearly 2d. per car-mile, or £94,250, remains. Mr. Stevenson deprecates the extravagant views of the Glasgow Tramways Committee in regard to depreciation, and further suggests the reduction of all fares above 1d. to that figure, justifying his views by the statement that the estimated margin of £94,250 would have been reduced by a sum of £31,000 only, if his suggestions had been adopted.

On Tuesday last Colonel Yorke, the Board of Trade inspector, went over the tramway extension from Springburn to Bishopbriggs, Alexandra Parade to Riddrie, and Rutherglen Bridge to Shofield Soll.

G.N. and Brompton Railway.—A claim for compensation for two freehold houses at St. George's Place, Hyde Park Corner, required by the Great Northern and Brompton and Piccadilly Railway Co., and for depreciation of value of adjoining houses, was heard on 26th inst. before Mr. Under-Sheriff Burchell. £40,000 was claimed, but a settlement was arrived at, it being agreed that the claimants should receive £30,750 for the freehold of the two houses, and all their rights over adjacent land.

Hounslow.—A L.G.B. inquiry was held here last week, says the *Daily News*, upon the application of the Heston and Isleworth Council, for power to acquire land compulsorily in order to widen Twickenham Road, Isleworth. On behalf of the Council it was urged that much danger to all traffic existed at the present time, owing to a service of 400 to 800 electric trams daily, increasing to 1,000 in summer. The rails were close to the kerbs in places, and in others there was no path at all. Col. Yorke, the Board of Trade inspector, had described places on the road as dangerous, but the tramway company would not assist to widen them. The inquiry closed.

Holland.—The Dutch Minister of Public Works has just granted the concession of the construction of an electric railway from Amsterdam to Harlem. The line must be completed within two years. The concession is for 50 years.

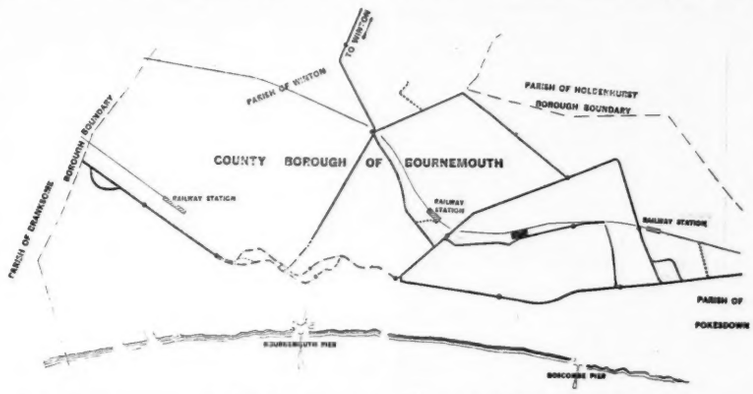
Rochester.—The Kent Electric Power Co. have decided to withdraw their Bill for the proposed tramways to run from Rochester to Maidstone, and from Rochester to Gravesend. The Chatham and District Light Railways Co. have also promoted a like Bill, and it is understood that some arrangement has been come to in the matter.

(*Continued on page* 191.)

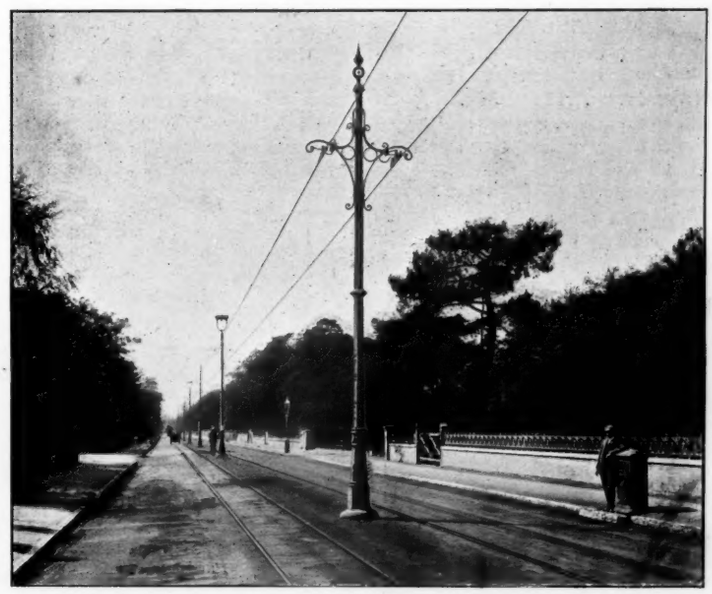
BOURNEMOUTH CORPORATION TRAMWAYS.

(*Concluded from page* 149.)

The track of the Bournemouth tramways is, of course, the feature of special interest, as this is the only example of the combined trolley and conduit systems existing in this country. The cost of adopting the conduit system throughout would have been absolutely prohibitive, and we question whether the Corporation has done wisely in installing it on even a portion of the tramways; not only the capital outlay, but also the cost of maintenance and renewals is increased, and the liability to breakdowns and disorganisation is certainly greater in the case of the conduit than in that of the trolley system. There is a disadvantage also in the separation of the supply to the conduit from that to the trolley feeders, though this is mitigated somewhat by the use of a motor-generator to transfer power from one side to the other. Whether these drawbacks are compensated for by the absence of the alleged unsightly trolley wires or not, must remain a matter of opinion.



Map of Bournemouth Corporation Tramways.



View of Overhead Construction.

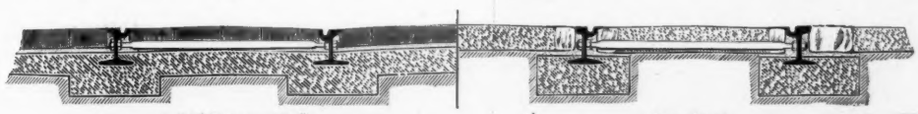
The track is laid to a gauge of 3 ft. 6 in.; the total length of single track is 18 miles, of which the conduit section embraces 3 miles. Several of the routes are double-track, but there are portions laid single, with turn-outs. A considerable amount of street-widening was required to accommodate the double track, and the greater part of the conduit section consists of tracks laid in separate streets.

The rails weigh 100 lbs. per yard, and were supplied and laid by the contractors, for Messrs. J. G. White and Co., who were responsible for the whole of the permanent way, overhead and conduit construction. Cross-sections of the track on both parts of the tramways are given herewith. The trolley track was laid on a bed of concrete 6 inches thick, and the rail joints are made with both fish-plates and sole-plates. The special work at points and crossings was done by Messrs. Hadfield's Steel Foundry Co., Ltd., with their special manganese steel.

The overhead equipment includes both bracket arm and span wire construction; sectional steel poles are used, from 7 to 9 inches diameter at the base, $4\frac{1}{2}$ to $5\frac{1}{2}$ in. at the top, and 31 ft. long. The bracket arms are of steel tapered tube, with neat wrought-iron scroll work, and the poles are fitted with ornamental cast-iron bases, with the Corporation's arms in relief. The trolley wire is double throughout, of ·384 in. hard-drawn copper.

Arc lamps for public lighting are carried on certain of the poles, to the number of 83, the remainder being mounted on special cast-iron poles.

The sections adopted for the conduit slot rails, yokes, conductors, &c., are shown in the figures on page 190. The slot rails are 6 in. deep, and weigh 60 lbs. per yard; over the greater part of the route the conduit is under the inner running rail, the car wheels running on the outer of the slot rails. The yokes are fixed at intervals of 3 ft. 9 in., the intervening spaces being filled up with concrete moulded to form the walls and floor of the conduit, 6 inches thick.

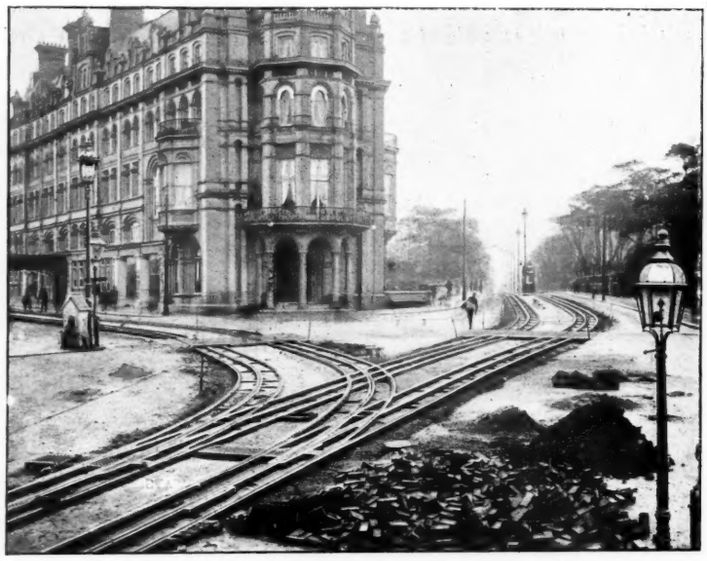


Sections of Track on the Trolley Routes.

Manholes are provided at intervals of 120 ft., and catch-

pits for drainage every 400 ft.; the latter are connected with the main sewers. The insulators are spaced 15 ft. apart, in recesses provided in the sides of the conduit.

The normal dimensions of the conduit are 2 ft. 0½ in. deep from the top of the slot rails and 14½ in. wide inside; the yokes are 8 in. deep and wide, and are bedded in concrete, so that the maximum depth overall is 3 ft. 0½in., and the extreme width has the same value. The width of the slot is 1 in. at the side, and ¾ in. when the slot is in the centre, the larger value being required to accommodate the flanges of the car wheels. The design employed for the conduit, plough, &c., closely resembles that used for the Paris side-slot lines carried out by Mr. A. N. Connett, who is also responsible for the design of the equipment of the Bournemouth conduit system; the details of the Paris installation were described by Mr. Connett in a paper read before the Institution of Mechanical Engineers in 1901, and abstracted in the REVIEW, Vol. 48, pp. 517 and 563.



TERMINUS OF CONDUIT SECTION AT HOTEL METROPOLE, SHOWING SLOT IN CENTRE OF TRACK.

The slot rails are bolted to the yokes, and are also stayed by short tie-rods to the outer horns of the yokes; between the alternate yokes the inner slot rail is also tied to the outer track rail. The construction of the joints in the slot rails is shown by the illustrations given below (p. 190). It will be noticed that the "drip" is provided along the foot of the rail.

The conductors are of steel, of **T** section, contact being made with their vertical surfaces; the conductor rail weighs 22½ lbs. per yard. The distance between the opposite faces of the conductors is 6 in., and the distance of their centres below the top of the slot rail 14¾ in. The rails are suspended from porcelain insulators, which are cased in iron and bolted by means of the casing to the slot rails. The pins projecting from the bases of the insulators are provided with adjusting nuts to regulate the height of the conductor rails, and means are provided also for adjusting the horizontal distance between their faces. At alternate insulators the ends of the rails are held in clamps forming the joints, and the latter are double-bonded.

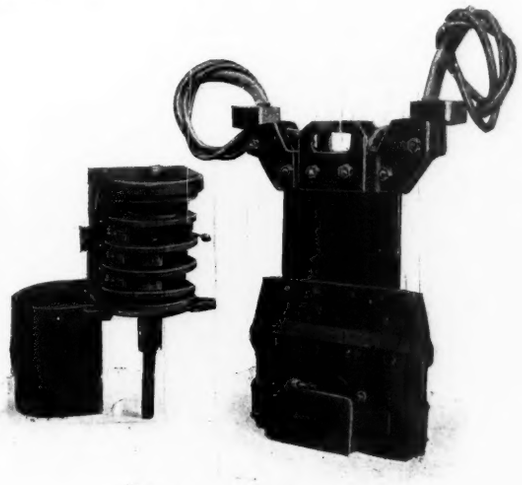
Special traps are provided at the termini of the conduit lines, seven in all, for the removal of the plough in changing over from underground to overhead work, and *vice-versâ*. These are fitted with doors carried by a parallel-motion device, so that they can be opened wide without requiring more than a few inches vertical head-room; the mechanism is counterweighted so as to minimise the effort required to open them, and it is operated by means of a lever at the side of the track.

Owing to the mechanical and electrical difficulties involved in the construction of crossings and junctions with the side-slot system, at all such points the slot is deflected to the centre, the rails being so arranged as to guide the plough automatically into the centre without interfering with the free running of the wheels. For this purpose the plough carrier is so designed as to permit the plough to slide sideways the whole width of the truck, on the system devised by Mr. Connett for the Paris lines. Special arrangements are made at the ends of the conductor rails to ensure that the

WESTERN TERMINUS OF CONDUIT SECTION, SLOT AT SIDE.

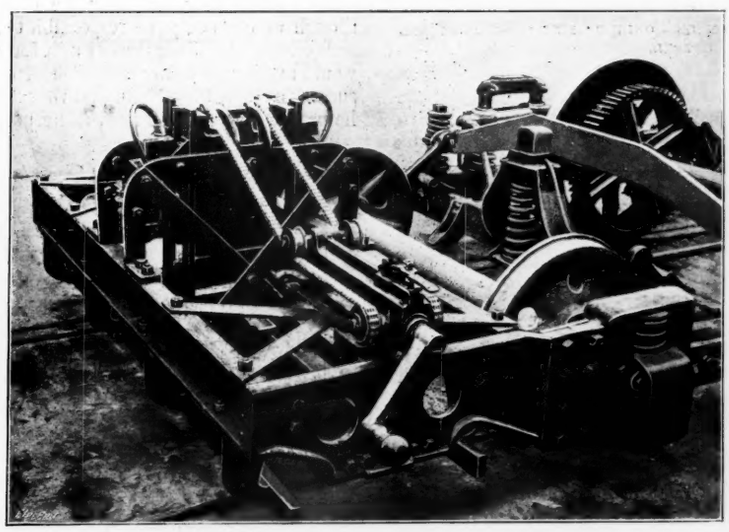
SIDE SLOT CONDUIT IN COURSE OF CONSTRUCTION.

plough shall enter upon its proper path with ease and certainty.



Change-over Switch and Plough.

The plough is provided with cast-iron slipper blocks, supported against horizontal motion by links, and pressed outward by elliptical springs. It is raised and lowered by means of chains carried over pulleys, the bight of the chains being pulled in by a sliding block operated by a screw and travelling nut. The plough itself is shown, with a change-over switch, in one of the illustrations on this page, while others show the truck with the plough raised and lowered. The operation of changing over is said to cause practically no more delay than is involved in placing a trolley wheel on the wire.



Maximum Traction Truck, showing Plough-raising mechanism; Plough in Uppermost Position.

The rolling stock comprises 20 bogie cars, capable of seating 30 passengers inside and 32 outside, and 18 single truck cars, seating 20 inside and 22 outside. All the car bodies, which are of the double-deck type, were supplied by Messrs. G. F. Milnes, of Hadley.

The bogie trucks are of the Brill maximum traction type, with 4 ft. wheel base, and wheels 30 and 20 in. in diameter. The trucks are at 16 ft. centres. The bodies measure 22 ft. 7 in. in length inside, and 33 ft. 6 in. over the platforms. Hand and rheostatic brakes are fitted. The trolleys are of the swivelling type. Each car is fitted with a watt-hour meter, and an ammeter is fixed within sight of the driver on each platform. The cars are lit with 15 lamps of 16 c.p. each, two lamps being provided on the roof.

The four-wheeled cars are fitted with Peckham trucks, with a wheel base of 5 ft. 6 in. These cars have hand, rheostatic, and track brakes; the bodies measure 15 ft. 2 in. inside, and 26 ft. over the platforms.

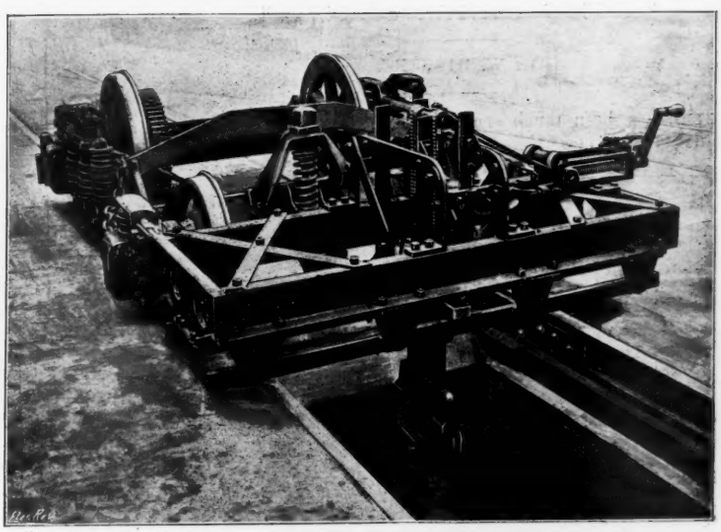
The electrical equipment is of the standard type of the British Westinghouse Co., who were the contractors for the cars, their 49B motor being used throughout.

The contract for the cables for both lighting and traction was placed with Messrs. Callender's Cable and Construction Co., Ltd., who also supplied the section switch pillars, &c. There are 21 of the latter, of cast-iron, fitted with the necessary switch fuses, &c. There are also three special switch boxes for the conduit section, in which both poles of the feeders are insulated. The section pillars are fitted with the General Electric Co.'s special Traction Telephones.

The traction feeder cables are of various sizes, paper-insulated and lead-covered, and are drawn into stoneware ducts of Doulton and Jennings make. There are two return feeders from the track, each of 1 sq. in. cross-section; pilot and telephone cables are also provided. It is interesting to note that the specifications called for tests with 4,000 volts alternating, after the lead had been stripped off and the cable soaked in water. The final test applied after the cables were laid in place was with 2,000 volts alternating for 30 minutes.

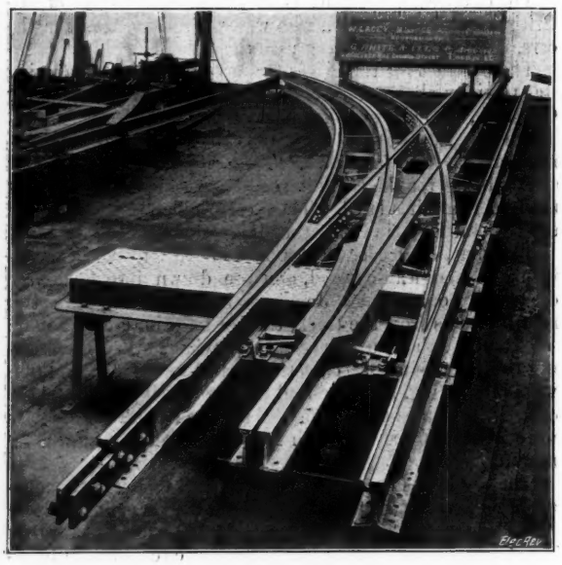
The arc lamps are of the Brockie-Pell double-carbon 10-ampere type, run 11 in series, and fitted with split globes to facilitate trimming. There are in all 131 arc lamps, on six circuits. The lighting feeders are concentric, of the same type as the traction feeders.

The car shed adjoins the generating station, and provides accommodation for the whole of the rolling stock. It is fully equipped with heavy lathes, drill, wheel presses, &c., for dealing with all ordinary repairs and renewals. The depôt comprises 7 sidings, the points and crossings for which (and for certain portions of the lines) were supplied by Messrs. Askham Bros. and Wilson, Ltd.

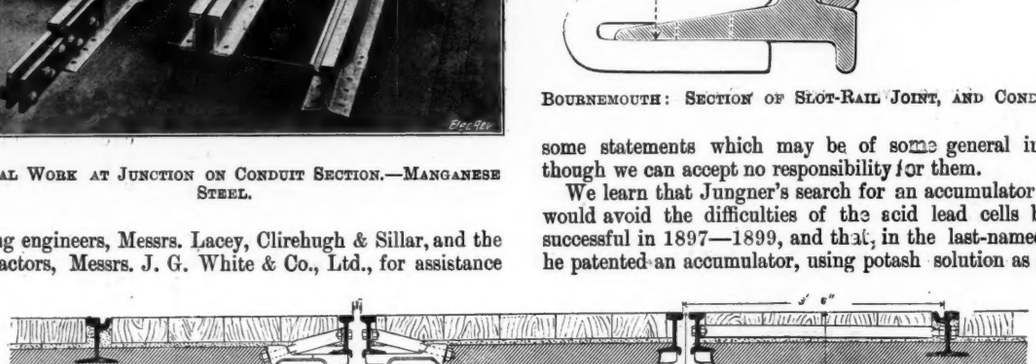


Truck with Plough Lowered.

Our thanks are due to the borough engineer, Mr. F. W. Lacey, for facilities to obtain photographs, and to the consulting engineers, Messrs. Lacey, Clirehugh & Sillar, and the contractors, Messrs. J. G. White & Co., Ltd., for assistance in the preparation of this article. Mr. Bulfin is the resident engineer, and Mr. W. Goodger was the engineer in charge of the work during construction.



SPECIAL WORK AT JUNCTION ON CONDUIT SECTION.—MANGANESE STEEL.

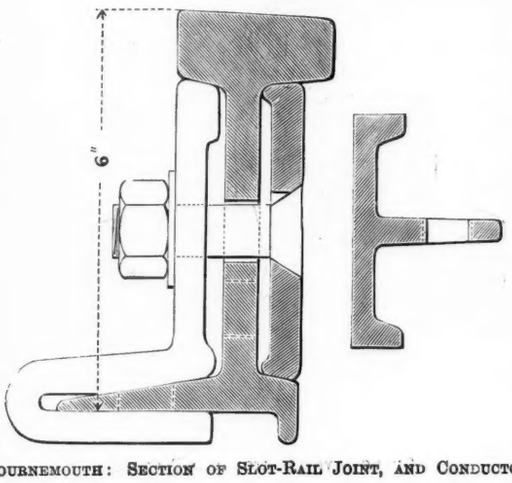


SECTION OF CONDUIT TRACK AT YOKE, AND BETWEEN YOKES.

"EDISON CONTRA JUNGNER."

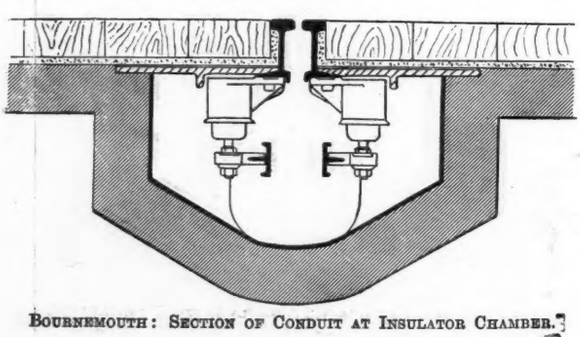
BY W. HIBBERT.

THERE has been much speculation as to the prospective value of the new Edison alkaline accumulator. At the present time, the speculation has become tinged with doubt as to its capacity to do better work than that already obtainable from lead cells; and it now appears that there is some chance of its merits being seriously claimed by other workers, for the title of this article forms the heading of a corresponding article in a Stockholm paper, *Nya Dagligt Allehanda*. From this article (which is printed in English) we gather some statements which may be of some general interest, though we can accept no responsibility for them.

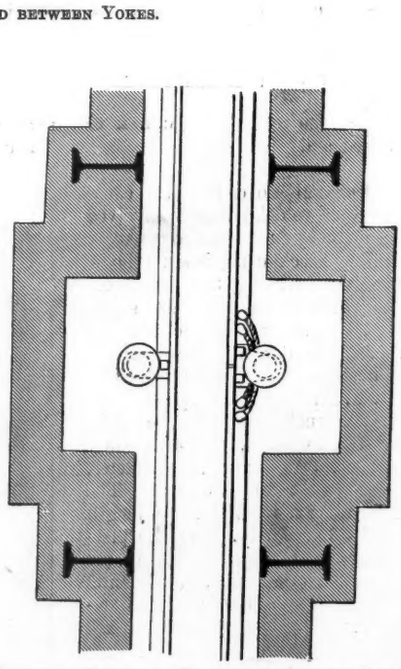


BOURNEMOUTH: SECTION OF SLOT-RAIL JOINT, AND CONDUCTOR

We learn that Jungner's search for an accumulator which would avoid the difficulties of the acid lead cells became successful in 1897—1899, and that, in the last-named year, he patented an accumulator, using potash solution as liquid,



BOURNEMOUTH: SECTION OF CONDUIT AT INSULATOR CHAMBER.



BOURNEMOUTH: SECTIONAL PLAN OF INSULATOR CHAMBER.

and plates of such powdered metals or oxides of metals as were insoluble in the liquid, and gave sufficient electric pressure. Later patents have been improvements in details

only. The oxides first specified were those of cadmium, copper, iron, manganese, silver and nickel.

After due demonstration, Jungner's patents were bought by a great Scandinavian company in May, 1900, and some months later an American automobile furnished with Jungner cells was tried under official conditions. The automobile, excluding battery and riders, weighed 528 kilogrammes (1,162 lbs.). The battery weighed 290 kilogrammes (638 lbs.). On wet and muddy roads about 140 kilometres (87 miles) were covered by one charging. The final test was made in the streets of Stockholm, under very strict conditions. The distance covered during one discharge was 148·5 kilometres (92 miles), the tension (potential difference?) not falling below the normal. At the end of the test, the automobile travelled at a speed of 26·5 kilometres per hour, that is, at 16·5 miles per hour. These figures are certainly very good so far as they go.

The battery used in this automobile appears to have contained an electrode of powdered oxides of nickel and silver. But Jungner found these expensive, and also observed that an asbestos paper used for separating the plates had to be changed after about 120 discharges. He therefore fell back on a nickel peroxide as positive, and powdered iron as negative metal. This was in the autumn of 1900, and the combination is mentioned in his Swedish patent of January 21st, 1901. It is claimed that this date gives priority over Edison's patent of February 5th, 1901, and, as a consequence, that Edison had to put a large disclaimer in his English patent. It is even said that Edison will be dependent on the licences he can get from the Jungner Co.

All this is interesting, in view of the general expectation of news from Mr. Edison about his promised 100-mile run. When that is publicly announced, will its merits be claimed by Jungner? If 92 miles could be run in 1900, it ought to be possible to manage the 100 miles now, for the recent improvements in cars, and presumably in Jungner's cells, ought to bring the additional eight miles within practical possibility.

On the legal question it would be foolish to give an opinion as yet. In an article in this journal, criticising Dr. Kennelly's first description of the Edison cell, Jungner's work was alluded to (ELECTRICAL REVIEW, June 21st, 1901), though Dr. Kennelly had not apparently mentioned him. The information then to hand was obtained from non-technical sources, by verbal statements of a Norwegian friend, in fact, and was not over precise. But about March, 1901 (two months before Dr. Kennelly's paper), I was told that Jungner had run motor cars with alkaline accumulators, using an oxide of silver. The more particular statements now made suggest that at this date the Swedish engineer had arrived at a form of battery almost identical with that subsequently described by Dr. Kennelly.

For further judgment we must wait for official statements from both parties, or until they put their cases before the jury which it is suggested will have to decide. Already some pleadings appear to have been exchanged, and if the commercial possibilities of the cell are such as to warrant the statements of both Edison and Jungner, there will no doubt be a big legal battle over the question of proprietary right.

ELECTRIC TRACTION NOTES.

(*Continued from page* 186.)

Huddersfield.—In all £3,954 has been paid out by the Tramways Committee in compensation for injuries received in the Mold Green car accident, which occurred on June 28th, 1902. The town clerk reported as to the advisability of the Corporation carrying passengers on their tramcars only at reduced fares, and subject to the bye-laws, and with a special condition limiting liability in cases of injury to a sum not exceeding £25, and that, subject thereto, passengers must travel at their own risk. Instructions were given to the manager to have the above condition painted in prominent letters on each side of each car, and that each conductor have special instructions on the issue of every ticket to draw the attention of each passenger to the special condition as above printed on the ticket. As the maximum fares allowed by the Corporation's powers are in no case charged, the new regulation will apply to all passengers; but as to how far it will be applicable when tested in the law courts, of course, remains to be seen.

The receipts from the steam sections of the tramways for the nine months ended December 31st, 1902, amounted to £2,554 16s. 4d., or 12·82d. per mile. The total expenditure, after allowing for depreciation (£184 5s.) and interest and sinking fund (£526 14s. 8d.) was £3,122 8s. 3d., or 15·67d. per mile, a loss of 2·85d. per mile. On the electric sections for the same period the receipts amounted to £40,391 17s. 7d., or 10·51d. per mile. The total expenditure, after allowing £6,294 13s. 7d. for depreciation and £14,307 9s. 7d. interest and sinking fund, amounted to £42,196 17s. 6d., or 10·97d. per mile, a loss of ·46d. per mile. The receipts for the month of December, 1902, amounted to £4,447 11s. 11d., or 9·27d. per car-mile, and an increase of £591 15s. 9d.

The manager has been instructed to mount a bogie car upon an extra suspension truck of the British Electric Car Co., and to have the British Thomson-Houston magnetic brake fitted thereto.

Japan.—A project is being promoted by the Osaka Electric Lighting Co., Osaka, for the construction of a system of electric tramways in that city, the greatest manufacturing centre in the empire, with a population of close on half a million. The present power station of the company would be enlarged to meet the increased demand of energy.

Lancaster.—The electrification of the tramways in Lancaster includes a project for the acquisition by the Corporation of the old Lancaster and Morecambe Co.'s undertaking. Negotiations for the purchase took place a year or two ago, but no agreement could be arrived at. More recently an attempt has been made to settle the price, but the company's demands being in excess of what the other side considered reasonable, an expert was called in to inspect and report upon the value of the undertaking. The report has not yet been published, but it is understood that the difference between the company's valuation and that of the expert is only some £7,000 or £8,000, in which case there is not likely to be much delay in coming to an arrangement. The bulk of the traffic between Lancaster and Morecambe is in the tourist season, and the possession of this route by the Corporation is considered essential to the success of the general tramway scheme. In respect of population Morecambe is, in fact, the only suburb of any importance.

L.B. and S.C. Railway.—The directors in their report for the last six months say:—"Authority is also sought (in the new Bill) to establish and use electrical power stations and plant, and to work any part of the company's system by these means. This authority will enable the directors to adopt either wholly or partially any system of electrical traction which is proved to be of practical and commercial value, and in the meantime the powers will render it possible to make an extended use of electricity for lighting purposes, and to provide means for handling merchandise traffic at the company's wharves and goods depôts in a more economical and efficient manner."

Lees.—The D.C. is to make application for a £5,500 loan for the purpose of tramway works. A deputation will wait on the Oldham Corporation shortly with respect to the construction of the tramways within the Lees district.

Liverpool.—The Tramways Committee has decided to form another electric car route, for an experimental service. The route will be from the junction of Sandhills Lane and Derby Road, Liverpool, on the north; then inland, towards the east for nearly a mile; southward for about 1½ miles; and then westward to the pier-head, the main terminus by the River Mersey, and the landing stages. The return journey will, in part, lie through different thoroughfares from the journey above described.

Liverpool Overhead.—According to the *Liverpool Mercury*, various rumours are current as to the future ownership of the Liverpool Overhead Electric Railway, which, without the formality of consulting the shareholders, has been successively assigned to the Liverpool Corporation (to form a part of the tramways system), and to several trunk railway companies. Despite the fact that a Bill has been drafted, and other steps taken to form a Seaforth and Sefton Junction Railway by linking the overhead system with that of the Liverpool and Southport Extension Railway, a report is afloat that the Midland Railway Co. are seeking to acquire the Overhead as part of a new scheme of development.

Llandudno.—The Light Railway Syndicate, which holds the order authorising the construction and working of the electric railway between Llandudno and Colwyn Bay, has asked the U.D.C. whether, in the event of the Council being prevented by injunction from supplying current outside the urban district, the Council would still undertake to supply current in their district on the terms previously agreed to. It was decided, in the event of an injunction being obtained, that the company should pay for such portion of the line as the Council did not supply with current, compensation based *pro rata* on the sum of £500 intended by the agreement of May 18th, 1898, to be paid as a wayleave in the event of the company supplying their own current throughout the whole of the undertaking.

London.—LONDON COUNTY COUNCIL.—At the meeting on Tuesday, the Parliamentary Committee presented a report in regard to the action taken by them during the Christmas recess in relation to certain tramway Bills of the session of 1903. The first was the Beckenham Urban District Council Bill, which contain a proposal for a short length of tramway in Lewisham, against which a memorial had been sealed. It had, however, now been held that, owing to more than two-thirds of the line, of which the above-mentioned length forms part, being within the district for which

the promoters are the local and road authority, the consent of the County Council was not required in order to enable the promoters to comply with the Standing Orders of Parliament in respect of the tramway. The Committee stated that they were in communication with the District Council, and hoped shortly to be able to report the result of the negotiations.

In the Croydon and District Electric Tramways (Extensions) Bill, the British Electric Traction Co. seeks powers, among others, to construct two lines in London—namely, in Lewisham and Wandsworth respectively. Apart from other considerations, the Committee said that it did not appear that either of the thoroughfares to be traversed by these lines were sufficiently wide to afford the statutory distance between the kerb and the rails except in places, and there was no proposal in the Bill for the widening of the roads. The Highways Committee intimated that the Council's consent should be withheld, and a memorial was presented against the part of the Bill in question. It had now been held that the Bill did not comply with the standing orders in this respect, and in the ordinary course the Committee stated that the clauses dealing with the lines in question should be struck out of the Bill.

The Erith Tramways Bill, which proposes the construction of tramways in Woolwich by the Erith U.D.C., was also opposed by the Committee by the presentation of a memorial. It was, however, held that the Council's consent was not required in view of the fact that more than two-thirds of the lines of which the above forms part, would be within the district for which the promoters are the local and road authority, and the Bill had accordingly been allowed to proceed. The Parliamentary Committee remarked that it would now remain for the Council to take such action as might be thought necessary when the Bill was before Parliament.

The last Bill referred to by the Committee was the Harrow Road and Paddington Tramways Bill, which only projected, in so far as London is concerned, a very short length within the county boundary. As this section was so very short, no opposition on Standing Orders was taken by the Council, thus leaving any action in the matter for the time when the Bill came before Parliament.

Lytham.—Rapid progress is being made with the construction of the new electric tramway between South Shore and Lytham. Double lines are already laid for a considerable distance. The track from Lowther Gardens to the Cottage Hospital, at Lytham, will be single only, with passing places. The contract is to be completed by May. Tourists will then have the advantage of a through service of electric trams along the Lancashire coast from Lytham, through Blackpool, to Fleetwood, a distance of 15 to 20 miles.

Manchester.—The tramcar drivers and guards, to whom liberal concessions were recently made, are still agitating for an alteration in the arrangement of their hours. They ask that the staff shall be divided into two sets, so as to enable each man to put in his eight hours per day without a break. The request is being considered.

Merthyr.—An electric car descending a steep incline left the rails and collided with an iron standard. The car was wrecked, but no one was hurt save the driver.

Middlesex.—The Middlesex Light Railways Committee will consult an electrical expert as to the working of its electric tramways, for which the Board of Trade has now passed plans. Messrs. Griffiths are to construct the lines in the parish of Finchley. The work will be shortly commenced.

Morecambe.—The T.C. has arranged a conference with a representative of the B.E.T. Co. relative to the electrification of the tramways.

New York.—New York City's underground rapid transit system will be in full operation in the autumn of this year, probably in October. Trial cars will be run over the route in June or July, by which time the work of construction will probably be completed.—N.Y. *Electricity*.

Newport (Mon.).—Mr. G. H. Winsor has been appointed manager of the Newport electric tramway system which will soon be ready for opening. The drivers of the present horse cars are to be retained and trained as motormen for the new cars, the training beginning with the arrival of the first electric car from the makers.

The contractor's plant used for the erection of the new power station of the Newport Corporation is to be sold by auction in middle of February. Messrs. A. T. & E. A. Crow, of Sunderland, will conduct the sale.

Northwich.—The U.D.C. has appointed a committee to consider the advisability of providing electric tramways.

Norwich.—At a recent sitting of the Norwich County Court, three cases involving the Norwich Electric Tramways Co. were heard. In the first case a Mrs. Humphreys sued the company for damages alleged to have been received through a collision which occurred on the evening of September 8th. The evidence was of a conflicting nature, and a verdict was returned for the defendant company with costs.

A second case, also arising out of a collision between a tramcar and a farmer's trap, was considered proved, and a verdict for plaintiff for £8 and costs returned.

The third case—by the farmer's assistant in connection with the collision in the previous case—ended in a judgment for plaintiff for £6 with costs.

Royton and Crompton.—The U.D.C.'s are negotiating with the Oldham Corporation for the transference of their tramway orders to the latter authority.

S.E. and Chatham Railway.—The directors' report for the last half of 1902 concludes: "The question of electric traction is so important that the managing committee have recommended the introduction of clauses in their Bill to provide for its adoption on such portions of the line as might hereafter be found desirable, and for the erection of generating stations for that purpose at various places."

Wrexham and Rhos.—On 26th inst. a successful trial run was made by one of the electric cars on the Wrexham District Tramway, which connects the populous districts of Wrexham, Rhostyllen, Johnstown, and Rhosllanerchrugog. The system covers a total length of four and a half miles, but only about two-thirds of this was ready for testing. The permanent way was laid by Messrs. Dick, Kerr & Co., the feeders were supplied by the British Insulated Wire Co. It is intended to run a 20 minutes' service between Wrexham and Rhos, and the line will be opened for traffic very shortly.

Melbourne Railways and Electric Traction.—A Melbourne dispatch to a Sydney paper (December 23rd) says:—"Some time ago Mr. Melville, M.L.C., submitted a memorandum to the Minister for Railways (Mr. Bent), dealing with an electric railway constructed in the State of Ohio, United States, America. A schedule of the cost was enclosed, from which it appeared that the Victorian suburban system might be converted at a comparatively small outlay. Mr. Rennick, engineer-in-chief, states that the line referred to is an electric railway, 31 miles long, and a single track with eight stations, and was to be worked independently of any other system. There was provision for only eight cars for passengers and two for freights. This in itself showed the insignificant traffic that was expected. There was no comparison between that and the busy suburban system of Melbourne. The construction of such a line, Mr. Rennick estimated, would cost 50 per cent. more at Melbourne than in Ohio. The cost of providing a power house for the generation and distribution of the electric energy was no less than five times the cost of providing steam locomotives for the same traffic. When there was added to this the cost of electric equipment, cables, rail conductors, rail-bonding, and substations, amounting to from £3,000 to £6,000 per mile of double lines, and the cost of electric motors and equipment of cars (the cost on each car would be from £500 to £1,000), it would be seen how large must be the capital outlay for conversion of a steam to an electric system for a heavy suburban traffic. Electric railways were more costly to instal than steam, and were, if anything, dearer to work. Their advantages lay in the fact that they were superior in comfort and cleanliness, could be well lighted, that they travelled more quickly, and a more frequent service could be given with them. Mr. Rennick concludes his report by framing an estimate of the cost of installing the system on some of the north suburban lines. The distance for the double lines is 33 miles, and the estimated cost £675,000. It would, however, he adds, be the height of folly to proceed to electrify a portion of the railways without making a scheme for electrifying the whole."

Mersey Railway.—Several trial runs have been made with the new electric motor-cars over the Park Station—Hamilton Square section.

Wolverhampton and Willenhall.—The Corporation having placed a horse tram track along the Willenhall Road—from the boundary of the borough of Wolverhampton at Coventry Street to Dean's Road, the boundary of Willenhall—communication with the latter town and Wolverhampton has now been restored, after being interrupted over two years. The Wolverhampton horse trams meet the British Electric Traction Co.'s trams at Dean's Road.

West Bromwich.—Another section of the tramway system—that between Carter's Green and Great Bridge—having been reconstructed and electrically equipped, it was officially inspected last week by Colonel Yorke on behalf of the Board of Trade. The section consists of a double line from Carter's Green to Whitehall Road, where a single line commences and is continued to the borough boundary. It is hoped that, in the course of three or four months the whole of the system will be completed.

Poole.—In connection with the proposed purchase of the Poole and District Light Railway by the Poole T.C., a meeting was held on Monday, 26th inst., at the Guildhall to consider a report by the Tramways Committee, and it was "resolved to write the Bournemouth Corporation, offering to purchase the undertaking, including running powers to the Square at Bournemouth at the price which has already been mentioned in Committee, subject to the passing of the Bill by which the Corporation will obtain powers to purchase, and to the sanction of the Local Government Board to a loan for the purpose of acquiring the undertaking, and to an agreement to be prepared between the two authorities containing the terms and conditions of the purchase; and that if such offer be refused the town clerk be instructed to take steps to oppose the Bournemouth Corporation Bill." Subsequently a discussion ensued as to the terms of purchase and working arrangements between the two Corporations.

Buenos Aires.—The Intendente has forwarded to the Buenos Aires City Council the request of the Electric Tramway Co., of Buenos Aires, to transfer its concession to the South American Syndicate, Ltd.—*Review of the River Plate.*

TELEGRAPH AND TELEPHONE NOTES.

Huddersfield Telephones.—The T.C. has instructed the Town Clerk to take the necessary steps to prevent the telephone license granted by the Postmaster-General being withdrawn.

Leicester Telephones.—The Special Telephone Committee of the T.C. considers that it is not advisable to establish a municipal telephone exchange at the present time. Certain new arrangements have been entered into between the N.T. Co. and the Committee with respect to wayleaves, but the Corporation reserves to itself the right to apply for a municipal licence.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	June 20, 1899 ..	..
Trinidad-Demerara No. 1	Aug. 27, 1900 ..	..
Dominica-Martinique	May 7, 1902 ..	..
St. Lucia-Martinique	May 7, 1902 ..	..
Guadeloupe-Martinique	May 7, 1902 ..	..
St. Lucia-St. Vincent	Nov. 18, 1902 ..	..
Martinique-Puerto Plata	July 10, 1902 ..	..
Guantanamo-Mole St. Nicholas	Aug. 4, 1902 ..	..
Cayenne-Pinheiro	Aug. 13, 1902 ..	..
Assab-Massowah	Dec. 30, 1902 ..	Jan. 22.
Reissi-Issa-Reissi-Yemani	Oct. 22, 1902 ..	..
Cadiz-Teneriff	Nov. 8, 1902 ..	..
St. Jacques-Haiiphong	Jan. 3, 1903 ..	..
Falmouth-Bilbao	Dec. 18, 1902 ..	..
Jamaica-Colon	Dec. 31, 1902 ..	..
Bissao-Bolama	Jan. 17, 1903 ..	Jan. 26.
Tenedos-Dardanelles	Jan. 21, 1903 ..	Jan. 27.
Silvebondo-Bandjermasin	Jan. 26, 1903 ..	..
Landlines :—		
Route to Tientsin and Taku *via* Helampo ..	June 18, 1900 ..	..

Wireless Telegraphy.—Orders have been given for wireless telegraphy to be established between Sheerness and Chatham by means of installations on the naval signal station at Garrison Point Fort, Sheerness, and on the wooden battleship *Algiers*.

It is announced in the newspapers that the Commission appointed at Rome to consider the project to connect Italy and the Argentina by wireless telegraphy has reported favourably upon it. The Italian station is estimated to cost £28,000, and this station will subsequently serve for Erythrea and Sardinia, and to communicate with ships at a distance not exceeding 200 miles. A dispatch from Rome says that a Bill to this effect has been adopted by the Cabinet.

A Reuter telegram from Berlin says:—"Professor Braun, of Strasburg, announces that he has made a great discovery with regard to wireless telegraphy, having found means to produce electric energy in unlimited volume, which can be projected into space in the form of electric waves to any distance. This new method, he asserts, secures increased accuracy of transmission, and promises to lead to a method of confining the current to the direction in which it is sent, so that the possibility of messages being intercepted will be much reduced."

CONTRACTS OPEN AND CLOSED.

OPEN.

Austria.—March 10th. Tenders are being invited until March 10th by the Austrian State Railway authorities at Lemberg for the supply and erection of a complete plant for the electric lighting of the railway station at Lemberg. Tenders are to be sent to Die K. and K. Staatseisenbahn Direction, Lemberg, whence particulars may be obtained.

Austro-Hungary.—March 10th. The Austrian State Railways, Lemberg, is prepared to receive offers for the supply and installation of electrical machines, and the installation of an electric lighting system in the Lemberg station. Upset price 350,000 crowns.

Barnes.—February 3rd. Free, hire or assisted wiring. See "Official Notices" January 23rd.

Batley.—February 2nd. Feeders, cables, conduits, arc light columns, &c., station wiring, instruments, &c., steel poles and overhead equipment, and switchboard. See "Official Notices" January 9th.

Belgium.—March 5th. Tenders are being invited until March 5th by the municipal authorities of Ghent, for the concession for the electric lighting of the town. Tenders are to be sent to L'Hotel de Ville, Ghent, whence particulars may be obtained.

Brussels.—The Belgian State Railways will shortly shortly announce an adjudication for the supply in eight lots of sundry objects necessary for the maintenance of the electrical installations of the Belgian State Railways. Particulars from the Bureaux des Appareils de Securité de la Voie, 76, Rue Belliard, Brussels. A contract will also be announced at an early date for supply of steel wire cables, copper ditto, incandescent lamps, &c., and the supply of two transformers for the Berchem lez Anvers power station.

Bulawayo. — February 26th. Establishment and working of an electric tramway. See "Official Notices" Nov. 21st

Colchester.—February 17th. Condensing plant and air and circulating pumps. See "Official Notices" to-day.

Darlington.—February 13th. Lancashire boiler, piping, feed-heater, traction feeders, permanent way construction, &c. See "Official Notices" January 16th.

Edinburgh.—February 16th. Electric light fittings for Colinton Mains Hospital. See "Official Notices" January 23rd.

Exeter.—February 19th. Doulton conduits, and two-phase feeder cables, for electricity supply. See "Official Notices" to-day.

Germany.—February 18th. The State Mining authorities at Königsberg are inviting tenders until February 18th for the supply of four electric travelling cranes and an electrically-operated turntable. Particulars may be obtained from, and tenders are to be sent to, Die Pieifbauamt., Königsberg, Prussia.

Gt. Yarmouth.—February 17th. 300-KW. steam alternator. See "Official Notices" to-day.

Guayaquil.—February 12th. The terms for the contract for lighting the city appeared in this column on January 2nd.

Hackney.—February 12th. 1,500-KW. steam dynamo and condenser, with electrically-driven pumps. See "Official Notices" January 9th.

Hammersmith.—February 11th. Electrical stores. See "Official Notices" to day.

Harrogate. — January 31st. Two 10-B.H.P. steam winches and one 10-B.H.P. electric winch. See "Official Notices" January 23rd.

Kingston-upon-Hull.—February 18th. Supply of all accessories, &c., for a complete telephone system. See "Official Notices" to-day.

Koloszvar (Austro-Hungary). — March 10th. The Municipal authorities of Koloszvar, Austro-Hungary, are prepared to consider tenders for the installation of an electric power station, for the supply of motive power. Estimates to be based on carrying out the enterprise either at the expense and risk of the town or of the would-be concessionnaires, and should be addressed to the municipality in question, at Matyaskiraly, No. 1, I. 5, Koloszvar.

Madrid.—January 31st. The Sociedad de Gasification Industrial de Madrid will, on the 31st inst., consider offers for the supply of seven machines of 1,500-H.P. each (for the use of the city electric lighting station) with all the necessary accessories.

Southampton.—February 14th. The Ordnance Survey wants tenders for four 7½-B.H.P. motors and four starting switches and resistances. See "Official Notices" January 23rd.

Spain (Valence).—February 7th. The Municipality of Valence wants offers for 50 columns in wrought-iron for the suspension of electric arc lamps. Up-set price, 600 pesetas each. Particulars from the administration above mentioned.

Stalybridge.—February 2nd. Electric tramcars with trucks and equipment complete, tower-wagons, overhead equipment and car sheds. See "Official Notices" January 9th.

Swansea.—February 9th. Lighting new portion of workhouse. "See Official Notices" January 23rd.

Tynemouth.—January 31st. Traction batteries and reversible booster.

West Ham.—February 10th. Electrical equipment of 8 miles of track. See "Official Notices" January 9th.

West Ham.—February 10th. Purifier, and re-erection of four Babcock boilers. See "Official Notices" January 23rd.

West Ham.—February 10th. Electrical supplies. See "Official Notices" to-day.

CLOSED.

Barnsley.—The T.C. has accepted the tender of Messrs. Venner & Co., of London, for a 12 months' supply of meters at the following prices: — Three-ampere, £2 10s. each; five-ampere, £2 15s.; 10-ampere, £3; 25-ampere, £3 5s.; 50-ampere, £3 10s.

Blackpool.—The Howard Conduit Co., Ltd., has received an order from the Corporation for the whole of the troughing for the Promenade and Lytham Road tramway and arc lighting extensions.

Bury.—Messrs. Browett, Lindley & Co., Ltd., have secured an order from Messrs. James Wrigley & Sons, of Bury, for an engine to develop 250 B.H.P. complete with condensing plant for driving their paper mills at Bury. This is the second extension which they have carried out for the firm.

Huddersfield.—Ten additional car-top covers have been ordered from Messrs. Milnes, Voss & Co., Birkenhead. The British Electric Car Co. is to supply 50 chilled wheels at 32s. 6d. each.

Hull.—The Corporation Electric Light Committee has accepted the tender of Messrs Thos. Parker, Ltd., for the supply of a dynamo at £1,815, this being £300 higher than the other tenders.

Kingston-on-Thames.—The T.C. has accepted the tender of Messrs. Prestwich & Burt, for wiring the new library at £152, and for wiring for motors at £14.

Sunderland.—The T.C. on January 14th accepted the tender of the Sunderland Forge and Engineering Co., Ltd., for supplying and fixing electric light fittings to the patients' villa and nurses' home at the Ryhope Asylum.

Swansea.—With reference to our last week's notice, the contract placed with Messrs. Bruce Peebles was for 12 months' supply of motors of ½, 1, 2 and 3-B.H.P. The contract for those of 5, 7, 10 and 15-B.H.P. motors for the year has been placed with the Keighley Electrical Engineering Co.

Walsall.—The T.C. has accepted the tender of Messrs. Thos. Parker, Ltd., of Wolverhampton, for the supply of two 100-KW. tramway transformers at £2,253.

The Corporation has accepted the tender of the Brush Electrical Engineering Co., Ltd., for the supply of 28 complete electric cars. The car-bodies and trucks will be built by the Brush Co., and supplied with motor equipments by the B.T.H. Co.

Wigan. — The E. L. and Tramways Committee has accepted the tender of Mr. Bertram Thomas for the switchboard extension.

FORTHCOMING EVENTS.

Friday, January 30th.—At 8 p.m. Institution of Civil Engineers. Students' Meeting. Paper on "The Design of the Electrical Equipment of a Light Railway," by J. R. MacIntosh.

At 7.30 p.m. Annual distribution of prizes and certificates, by Dr. T. J. Macnamara, M.P., at the Northern Polytechnic Institute, Holloway, N.

At 8 p.m. Electro-Harmonic Smoking Concert at Holborn Restaurant.

At 9 p.m. Royal Institution. Paper by Prof. W. E. Dalby on "Vibration Problems in Engineering Science."

Saturday, January 31st.—At 2.45 p.m. Institution of Electrical Engineers (Students' Section). Visit to the Notting Hill and Kensington Electric Lighting Co.'s joint works at Shepherd's Bush.

At 7.30 p.m. Grand Hotel, Charing Cross, Glasgow. Smoking Concert of the local section of the Institution of Electrical Engineers.

At 7.45 p.m. E.E. Volunteers. Smoking concert at headquarters, Regency Street, S.W.

Monday, February 2nd.—At 7.30 p.m. Society of Engineers. Royal United Service Institution. Inaugural Address by Mr. J. Patten Barber.

Wednesday, February 4th.—At 7.30 p.m. Institution of Electrical Engineers (Students' Section). Paper on "The Photometry of the Direct Current Arc," by Mr. T. H. Vigor.

At 5 p.m. Proposed Society of Electro-Chemists and Metallurgists. Faraday Club Room, St. Ermin's Hotel. To inaugurate the work of the Society, &c.

Institution of Civil Engineers. — Students' visit to the Electrical Standards Laboratory of the Board of Trade, Whitehall, S.W.

Thursday, February 5th.—At 8 p.m. Chemical Society. Paper on "A new principle for the construction of a Pyrometer," by J. S. Lumsden.

At 8.30 p.m. Röntgen Society, 20, Hanover Square. Discussion by Mr. J. H. Gardiner on "Some points suggested by the Presidential Address of November, 1902."

At 8 p.m. Civil and Mechanical Engineers' Society, Caxton Hall. Paper on "A description of a few of the most recent Water Turbine plants in Great Britain and Abroad," by A. Steiger.

At 8 p.m. Institution of Electrical Engineers. Meeting at Institution of Civil Engineers. Adjourned discussion on the "Metric System."

Friday, February 6th.—At 8 p.m. Junior Institution of Engineers. Meeting at Westminster Palace Hotel. Paper on "Calorimetry," by Mr. W. G. Wernham.

Saturday, February 7th.—At 7.30 p.m. Glasgow Technical College Scientific Society, 38, Bath Street. Paper by F. J. Rowan, on "The Science of Steam Generation."

Monday, February 9th.—At 7.30 p.m. Institution of Mechanical Engineers (Graduates' Association). Lecture by Dr. R. T. Glazebrook on "The National Physical Laboratory and Engineers."

Saturday, February 28th.—Annual Corps dinner of the Electrical Engineer Volunteers at the Trocadero Restaurant.

NOTES.

Electro-Harmonic Concert.—To-night, at the Holborn Restaurant, there will be a smoking concert of the Electro-Harmonic Society. A good programme has been arranged, including vocal music by the Concord Part Singers, Mr. C. Copland and Mr. Vivian Bennetts; pianoforte solo by Mr. Izard; glassophone solos by Mr. George Nelson; musical recitations by Mr. Arthur Helmore; conjuring feats by Dr. Byrd Page; and musical and humorous sketches by Mr. Astley Weaver.

Junior Institution of Engineers.—A large number of members paid a visit on January 17th to the new electricity works of the Metropolitan Borough of Shoreditch, Whiston Street.

At the next meeting on February 6th, a paper on "Calorimetry," is to be read by Mr. W. Garnet Wernham; on February 14th the eighteenth anniversary dinner takes place at the Hotel Cecil, the president, Col. Edward Raban, C.B., in the chair.

Personal.—Mr. Robert Hammond announces that he has admitted into partnership his son, Mr. Robert Whitehead Hammond, Assoc.M.Inst.C.E., A.M.I.E.E., and has also given an interest in his business to Mr. John May, Assoc.M.Inst.C.E., M.I.E.E., and to Mr. G. W. Spencer Hawes, M.I.E.E., who have been his chief assistants for many years. The business will in future be carried on under the style of Robert Hammond & Son.

On Sunday last, Mr. T. B. Holliday, the engineer and manager of the Brighton Corporation tramways, was the recipient of a testimonial in the form of an illuminated address and some useful articles for his own and Mrs. Holliday's use.

The Rotherham T.C. has appointed Mr. William Grant, of Darwen, as manager of the tramways.

Auction Sale.—Messrs. P. Huddleston & Co. will sell by auction on February 11th, at 12 o'clock, at 92—6, Railway Arches, Dalling Road, Hammersmith, a considerable quantity of electrical plant, &c. See our advertisement pages to-day.

Proposed Electro-Chemical Society.—We are asked to draw attention to a movement which is now on foot for the formation of a new Society of Electro-Chemists and Metallurgists. Mr. F. S. Spiers, of 82, Victoria Street, S.W., who is the hon. sec. of the Provisional Committee, informs us that the committee of the new society—which is to be called the Society of Electro-Chemists—held a meeting on January 6th under the presidency of Mr. James Swinburne, at which it was resolved, in consideration of the support and encouragement received in response to the circulars recently issued, to hold a general meeting of the supporters of the movement, and formally inaugurate the work of the society and to elect a President and Council. This meeting will be held at the rooms of the Faraday Club, St. Ermin's Hotel, Westminster, on Wednesday, February 4th, at 5 p.m. It has been suggested that there should be two classes of members—members and associated members—the subscription fees being two guineas and one guinea respectively. Intending members should communicate with Mr. Spiers at the above address.

The Bonus System at Bruce Peebles.—Before the Royal Scottish Society of Arts on Monday, Mr. M. T. Pickstone (of D. Bruce Peebles & Co.) read a paper on "British manufacture and foreign competition." Among other matters touched upon was the adoption of the bonus system of payment as the only means of obtaining a maximum output at the hands of workmen. The system had been adopted by Messrs. Bruce Peebles & Co. with considerable success. In the subsequent discussion Mr. Peebles said that the bonus system was an effective means of getting round the "ca' canny" policy of some Trade Union leaders, and he believed that it would become the universal method of paying wages.

The Employment of Youths in Electrical Works.—The Home Secretary will shortly issue an order under the Factory and Workshops Act, affecting the meal hours of youths under 16 employed in electrical works, &c. A second order permits youths over 16 to have night employment in electrical stations.

Railway Signalling.—A correspondent of a Newcastle daily says that the Railway Signal Co., of Fazakerley, is to fit up experimentally one of the busiest sections of the line at York with "all electric" signalling.

London Electrical Contractors' Dinner.—The dinner of the L.E.C. Association will be held in the King's Hall, Holborn Restaurant, on Thursday, March 19th.

Lecture.—Mr. Herbert A. Jones, of the Phœnix Dynamo Manufacturing Co., lectured to the Bradford Engineering Society on Wednesday, the 14th inst., the subject being "Electro-motors, with special reference to Machine Driving." A feature of the lecture was a number of slides illustrating motor-driven machine tools, specially prepared by, among others, the following firms:—Messrs. Craig & Donald, Glasgow; Messrs. Geo. Richards and Co., Broadheath; Messrs. Jas. Archdale & Co., Birmingham.

THE CENTRAL STATION ENGINEER.

WE regret to learn that Mr. A. BROMLEY HOLMES, who has been connected with the Liverpool Corporation electricity undertaking for the past 20 years—he, indeed, personally laid the foundation in 1883, of the department which has to-day assumed such enormous proportions—has had to resign the position of chief electrical engineer in consequence of ill-health. We suppose there is no other electricity works engineer in the country who has been so long in the thick of the business and engineering of electric light and power supply—certainly there are few central station engineers who have remained with a single undertaking for one-half the time that Mr. Holmes has been at Liverpool. Mr. Bromley Holmes has occupied a very enviable position in that city, and by his skill and ability has made the department a great success. From 1883 to 1896, the works were run by a company; and in the latter year the Corporation took them over, so that he has had prolonged experience both of company and municipal working, and has also turned out from his several light and power stations during the past year or two enormous quantities of energy for tramway working. Something of an idea as to the importance of the Liverpool system may be gained if we mention that during the year 1902, the output of the department was in excess of 23,000,000 units, and the works costs, including management, &c., have been brought down to ·9d. per unit. After payment of all charges for interest and sinking fund there remains a net surplus of over £33,000. It may be interesting to mention that in 1896 the output was 1½ millions; now it is 23 millions; the capital outlay was then £250,000, and now £1,500,000; but the charges to the consumers are now less than one half what they then were.

Mr. Bromley Holmes has been receiving a salary of £1,800 as chief engineer, but he relinquishes that office on March 1st, and from that date will act as the Corporation's consulting electrical engineer at a salary of £1,000 per annum. Mr. A. Clough, at present deputy electrical engineer at £700 per annum, will then become resident engineer at £800.

Following the starting of electric traction at Peterborough, the Corporation Electricity Committee has substantially increased the salaries of Messrs. T. ROWLAND, R. ROWLAND, and W. T. WARDALE, assistant engineers.

Dundee T.C. has appointed Mr. HENRY RICHARDSON, of Newcastle-on-Tyne, as electrical engineer at a salary of £400, in succession to Mr. W. H. TITTENSOR, who has proceeded to Preston.

The Huddersfield T.C. on January 21st appointed Mr. A. E. WHITWAM as superintendent of the electric supply station, and increased his salary from £180 to £200 per annum.

SUPPLY STATION ACCOUNTS.

York Corporation Electricity Accounts.

WE give this week an analysis of the accounts of the York Electricity Department.

As this undertaking only started in April, 1900, it will be seen that the results are in every way creditable to Mr. Midgley and his Committee, the department having earned substantial profits during its first two years of working, in spite of the high cost of fuel during the earlier portion of its existence.

The capital expenditure to March 31st last amounted to £55,832, and the total of the loans to date equal some £75,000.

GENERAL STATEMENT.

	1900-1.	1901-2.	Inc.
Total capital expenditure ...	£31,362	£55,832	£24,470
Number of units sold	222,369	423,000	200,631
Number of lamps connected ...	16,476	32,766	16,290
Maximum load in KW.	271	410	139
Gross revenue	£3,802	£6,110	£2,308
Gross expenditure...	£2,276	£3,518	£1,242
Gross profit	£1,526	£2,591	£1,065
Average price per unit sold ...	4·10d.	3·46d.	—·64d.

The total equivalent of 8 C.P. lamps connected during the years ending March, 1901 and 1902, was 16,476 and 32,766 respectively, and the units sold per lamp were 19·7 and 19·9 on the average.

The prices charged for private lighting during 1900-1 and 1901-2 were 7d. and 3d. and 7d. and 1½d. respectively; for public lighting, £20 per arc per annum; and for power and heat, 3d. and 1½d. respectively.

The average prices obtained for private and public supply during 1900-1 were 4·47d. and 1·9d. per unit, and in 1901-2 3·6d. and 2·7d per unit.

The total capacity of the plant for the two years under notice was 400 and 720 KW. respectively.

REVENUE STATEMENT.

	1900-1. Gross.	1900-1. Per unit.	1901-2. Gross.	1901-2. Per unit.	Inc.
Sale of energy	£3,702	4·00d.	£6,034	3·42d.	—·58d.
Motor and meter rents ..	55	·06d.	12	·00d.	—·06d.
Sundry fees, &c.	45	·04d.	64	·04d.	·00d.
Gross revenue ...	£3,802	4·10d.	£6,110	3·46d.	—·64d.

During the year 1900-1 the sum of £55 was received from meter rents, and during 1901-2 the sum of £12 was received from motor rents, nothing being charged to consumers for meter rental during that year, the decreased revenue per unit being, no doubt, due to the lower prices charged to lighting and power consumers.

COST OF PRODUCTION.

	1900-1. Gross.	1900-1. Per unit.	1901-2. Gross.	1901-2. Per unit.	Inc.
Coal	£992	1·07d.	£1,257	·71d.	—·36d.
Oil, waste, water, engine room stores and carbons.	121	·13d.	283	·16d.	+·03d.
Salaries, allowances and wages incurred in generation and distribution and attending street lamps.	353	·38d.	499	·28d.	—·10d.
Repairs and maintenance of buildings, engines, boilers, dynamos, and renewals to public lamps.	261	·28d.	461	·26d.	—·02d.
Works costs	£1,728	1·86d.	£2,501	1·41d.	—·45d.
Rent, rates and taxes ..	51	·05d.	238	·13d.	+·08d.
Management expenses, including engineer and clerical departments, printing, law charges, insurance and general establishment charges.	496	·54d.	778	·44d.	—·10d.
Total costs ...	£2,276	2·45d.	£3,518	1·98d.	—·47d.

The year's working shows an increase in gross revenue of £2,308, and in the gross profit of £1,065, the income for the year being £349, as against £409 in the previous year.

PROFIT STATEMENT.

	1900-1.	1901-2.
Interest on loans, &c.	£850	£1,282
Sinking fund	266	960
Net profit	410	349
Gross profit	£1,526	£2,591

CITY NOTES.

Eastern Telegraph Co.

THE report for the half-year ended September 30th last, which was presented to the meeting held on Wednesday, states that the revenue for the period amounted to £582,830, from which is deducted £156,888 for the ordinary expenses, and £69,185 for expenditure relating to repairs and renewals of cables, &c., during the half-year.

After providing £7,583 for depreciation of spare cable, £255 due to sundry differences in exchange and £10,461 for income-tax, there remains a balance of £338,507, to which is added £5,040 brought from the preceding half-year, making a total available balance of £343,547. From this balance there has been paid interest on mortgage debenture stock, £81,919; dividends on preference stock, £34,244; two interim dividends of 1½ per cent. each on the ordinary stock, £100,000. After carrying £10,000 to the reserve fund for maintenance ships and £145,000 to the general reserve fund, there remains a balance of £22,383, which is carried forward to the next account. The revenue includes £21,472 dividends for the half-year upon the company's investments in other telegraph companies. On the 1st inst. the tariffs from Great Britain and Europe to South and East Africa and Mauritius, and *vice versa*, were reduced from 3s. to 2s. 6d. per word, under the agreements for "standard revenue" entered into with the Governments of Great Britain, Cape Colony and Natal. The meeting of the International Telegraph Conference has been fixed to take place in London on May 26th next.

Sir J. WOLFE BARRY presided at the half-yearly meeting held at River Plate House, and in moving the adoption of the report, he said that the gross revenue for the period was £583,000, as against, in the corresponding period of 1901, £604,000, or a decrease roughly of £21,000. This decrease was mainly due to the reduction in the Indian, Australasian, Straits Settlements, Java and other tariffs, the most notable decrease—£17,000 for the six months—was in the Indian Joint-Purse receipts. Since the date of the accounts the tariff for messages exchanged between Europe and South and East Africa and Mauritius was further reduced to 2s. 6d. This traffic showed a satisfactory increase. The ordinary expenses amounted

to £157,000, as against, in the corresponding period of 1901, £143,000, or an increase of about £14,000. The bulk of the increase occurred in abstract "B," which was £11,000 more. Salaries and wages showed an addition of about £4,000, owing to the inevitable increase in the operating staff, and increments in the salaries of employés. The company's contribution to the cost of working other companies' joint stations was increased by £4 441. The amount paid to the Eastern and South African Telegraph Co. towards the expenses of Cape Town, Durban and Mauritius accounted for the major part of this increase. The additional expenses under the heading of joint stations had been incurred owing to the establishment of the new route to Australia *viâ* South Africa. In regard to repairs of cables, their ships had been exceptionally busy. The expenditure on repairs to cables showed an increase of £20,000. The length of cable used on repairs was quite abnormal, and was responsible for the somewhat large addition to expenditure under this head. The *s.s. Mirror* had undergone a general overhaul, and had been fitted with new boilers, and the electric light installation had been renewed. On account of this exceptional outlay they had made a contribution from the maintenance ships fund of £10,000, in reduction of the total cost of repairs to cables for the six months. Receipts from other companies on account of cable repairs this half-year were about £8,000 more. The amount written off the value of stock cable was heavier, in consequence of there being a larger stock in hand. The revenue account showed the receipts to be £20,000 less, and the total expenditure £35,000 more. They had placed to general reserve fund £145,000, or £55,000 less than last year. At first sight these figures might appear to show a falling-off as compared with the corresponding period, but they had two years of exceptional prosperity, which, although very gratifying at the time, had its disadvantages when comparisons were made. As a matter of fact, the present period was, with the exception of the last two corresponding half-years, the best since the formation of the company. They had applied £100,000 from the general reserve fund in further reduction of the cost of new cables, &c., leaving the general reserve fund £958,000. There was a sum of about £850,000, the balance of new cables, to be applied at some future date, so that they considered the reserve fund insufficient. During the last three years they had applied from the general reserve fund nearly one million and a quarter in reduction of the cost of new cables. This showed a splendid result, but they must not be satisfied until the whole of the remaining balance of £850,000 was also paid off, and their reserve fund was again in the position it occupied before the heavy expenditure on account of the new route to Australia, &c., was incurred. Their policy was to endeavour to keep pace with the legitimate demands of customers for reduced rates and improved facilities in connection with the receipt and despatch of telegrams, and whenever these improvements could be carried into effect without prejudicing shareholders' interests, no time would be lost in bringing the negotiations to a successful issue.

The CHAIRMAN, referring to the question of reduction in rates, said:—"With regard to the reduction of the rates for messages to and from Australasia, this, as you know, was brought into force by the action of the company's 'standard revenue' agreement with the contracting States, but I regret to say that, owing to the laying of the Imperial British Government Pacific cable and the consequent diversion of a portion of the traffic, the effect of the diminishing rate conditions will be suspended. There now being two systems to divide the receipts, it will be necessary for the traffic to develop to an unexpected extent before there will be sufficient work to enable us to earn the 'standard revenue' at the 3s. rate; therefore the reduction to 2s. 6d. per word will, we are afraid, be postponed for a considerable time; but we still hope that trade with Australia will ultimately revive, and that the traffic will increase to such an extent that the companies will earn their average standard revenue, and be called upon to reduce their rate from 3s. to 2s. 6d. per word. The tariffs which have been reduced by the Pacific Cable Board, owing to the opening of the Imperial Government Pacific Cable, are those between Australasia and Canada and the United States of America. The reason that these rates have been reduced is the fact that Canada and the United States are on the way between Australia and Great Britain, *viâ* the Pacific, and the new communication having been made by this route, it naturally follows that the countries on the line of route should benefit by a reduction. The result, however, is that Canada and the United States of America are practically the only countries that have benefited by a reduction of tariff by the new Government cable. The traffic between Australia and the United States is a fairly good one, and, we understand, has increased largely since the cable was opened. The reduction of tariff has been from 4s. to 2s. 8d. per word. The traffic between Canada and Australasia is very small. When these companies' new lines to Australia, *viâ* the Cape of Good Hope, were opened, there resulted a reduction of tariff between Australia and South Africa from 7s. 9d. to 2s. 3d. per word. This traffic, I am glad to say, has responded to this large reduction. The United States merchant has greatly benefited by a subsidised Imperial Government cable across the Pacific, paid for by British and Colonial taxpayers. The number of words actually carried by us during the six months under review, before the opening of the Pacific cable, with the tariff at 3s., was only 7½ per cent. in excess of the number of words transmitted in the corresponding period of 1901, when the rate was considerably higher, and the loss of revenue was conspicuous. The traffic has, therefore, by no means shown a satisfactory response to the reduction in rates, the receipts showing a diminution of about 14½ per cent. A very similar result will be found on analysing the Indian traffic, notwithstanding the more important reduction brought into operation on March 1st last. In order to earn the same amount of revenue at 2s. 6d. per word as we did under the 4s. tariff, it is necessary to carry 60 per cent. more words than formerly. Up to September 30th last the increase was only about 20 per cent. Although we cannot say how soon the normal traffic with India will develop sufficiently to recoup the present loss, we can only trust it will do so at some future time."

Since the completion of the British Government cable across the Pacific, which, with the landlines through Canada, and the lines of the existing North American cable companies, formed an alternative route to Australia, the Australian traffic has been well maintained, and they have been carrying more traffic than they had expected to do after the opening of this new route. The Pacific cable, which was started as a strategic necessity, had developed into a commercial competitor, but the directors thought strongly that any action of Government which unfairly benefited one commercial competitor to the exclusion of another equally entitled to a fair share of the undirected traffic, was wrong in principle, and should not be maintained. After a brief reference to the social telegraph code, and to the forthcoming International Telegraphic Conference, the chairman spoke as follows on the subject of wireless telegraphy:—

"I do not know if you wish me to say anything more on the subject of wireless telegraphy. If so, I am afraid my remarks must be as monotonous as the announcements of further developments and new discoveries which are now so familiar to us all. It is no doubt an interesting subject, and possibly more complacently infatuating to the general public than to the shareholders who have invested their money in the hope of receiving a substantial income from long-distance commercial etheric traffic. I have really nothing to add to or retract from what I have previously stated at these meetings, and, so far as I gather, no change has taken place in the opinion of those best qualified to judge in consequence of the latest reports of the experimental achievements. We still hold that the wireless system cannot, for reasons which to us are obvious, become a serious rival to long-distance transmission. It is not for me to put a limit on the possibilities of any branch of science, but everything physical has its limitations, and sensible men will gauge the probabilities; and no doubt our stockholders will continue to have confidence in the more material and concrete system of submarine cables, where the revenue is assured, so long as we continue to do our work to the satisfaction of our customers, and where the dividends are paid with the same regularity and certainty as the messages are received and transmitted."

The resolution that the report be adopted was seconded by Sir J. DENISON PENDER, and after a few remarks from shareholders it was adopted.

In the course of the remarks referred to, Mr. NEWTON asked for more information relating to wireless telegraphy. He referred to the messages which passed between President Roosevelt and the King; the message from the King was sent by cable, and the company, among its excuses, blamed Post Office red tape, but, asked Mr. Newton, "was it likely that a message sent by the King would be stopped by red tape?"

In reply to these and other observations, the CHAIRMAN said that the directors were not keeping back from the shareholders anything that they knew respecting wireless telegraphy. The whole business of the Marconi telegraphy was kept in such a state of mystery that the directors knew very little more than anybody who read the daily newspapers. Mr. Newton said that the original message reached England by ethereal telegraphy, but he (Sir John) did not know that at all. The reasons advanced for sending the message in reply by cable did not wholly satisfy the public. The public and the shareholders would naturally conclude that, had it been possible to send a message by wireless telegraphy, it would not have been sent by cable, even at the expense of waiting until the Post Office was opened, or requiring it to be kept open. It seemed a little strange that the Marconi Co. had not gone in for the trifling expense of a private wire from Mullion to Poldhu. He must leave them to draw their own conclusions from the patent fact that an important message from the King had been sent by cable. In regard to the confusion of different wireless messages, they had not been satisfied that any mode existed of getting over that difficulty. Marconi's work had been done with far greater secrecy than one would consider reasonable in the development of anything which was going to be of extreme utility. In regard to the transfer of the company's shares, Sir John quoted figures showing that for several half-years past the whole difference between the amounts represented by the transfers was only about £40,000 between the maximum and minimum. In the December half of 1901, £221,000 was transferred; in the June half of 1902, £228,000; the December half of 1902, £264,000.

The retiring directors and auditors were re-elected, and a vote of thanks closed the meeting.

Great Northern and City Railway Co.

THE report for the half-year ended December 31st last, to be submitted to the meeting on the 2nd prox., states that the generating station at Poole Street is finished. The tunnels and permanent way between Moorgate Street and Drayton Park are completed, and experimental trains have been run between these two points. Rolling stock to the extent of six trains of seven coaches each has been delivered, each train consisting of three motors and four trailers. The extension to Finsbury Park is progressing rapidly, and arrangements are being made for the immediate construction of the new station at Highbury Corner, and such portion of the extension to the Bank of England as will allow

of this latter work being completed under ordinary traffic conditions after the opening of the railway to Moorgate Street. The Bill which the company is introducing into Parliament to amend its Act of 1902, and to authorise the issue of additional capital in the form of preference shares, will be explained at the special meeting to be held after the general meeting.

Direct U.S. Cables Co.

MR. E. M. UNDERDOWN, K.C., presided at the half-yearly meeting on Tuesday. In moving the adoption of the report, he referred to the total receipts and expenses as given in our last issue, and said that the revenue showed an increase of £2,955 over the corresponding period of the previous year, while the working expenses had only increased by £199. The addition to the reserve fund of £7,475 interest on investments, £1,002 from sale of certain securities, and £10,000 from revenue, brought that fund up to £478,860 (at cost) at the end of the year. During the period under review they had made no outlay in respect of repairs of cables; they were in good working order for both simplex and duplex working. Since the last meeting the Pacific cable had been completed, bringing the other side—the Western Coast—of British America and the Australian Colonies into direct communication. It might naturally be supposed, inasmuch as that route made another route across the world, so to speak, in that direction, as a duplicate to the route which went the opposite way, and connected up some portions of the British Empire not hitherto connected, that the company would bring some of the traffic across its cables over the Atlantic to England. Up to the present time matters were still in course of negotiation, and at present the directors had not to report any considerable receipts from that source. They trusted to secure by arrangement with the other companies and with the Pacific Cable Board a share or portion of that traffic. In regard to wireless telegraphy, he did not think he had a word to add to what he had said on the last occasion, that it might in some way or other in the future affect Atlantic traffic. It might be a rival, and, if so, they must do their best not only to meet that rivalry, but to make use of any such appliances that they might find it advisable to employ. In the meantime the Direct United formed a portion of that huge network of cables which went all over the world, and they would endeavour to do their duty to the public, and he had little apprehension of the company being seriously affected by any such competition. They could not prevent a species of nervousness which seemed to be caused by those electric discharges which were reported to have gone in one direction, if not in two. As matters were still pending a resolution, he had better not go any more fully into the question. The directors had appointed his son to the board. It was advisable that visits should be made to the stations, and he would be useful in this as in other branches of the business.

Sir JAMES PENDER seconded the adoption of the report, which was carried without discussion.

Waterloo and City Railway Co.

THE report for the half-year ended December 31st last, to be submitted at the meeting on the 5th prox., states that the capital account shows a total outlay of £606,500 on December 31st last. The gross receipts of the line, less Government duty, amounted to the sum of £17,587, and the working expenses to £7,818, being at the rate of 44·45 per cent., as compared with 45·50 per cent. for the corresponding period of 1901. The balance available for dividend, after providing for interest on debenture stock, is £9,054, and a dividend at the rate of 3¼ per cent. per annum on the ordinary stock will absorb £8,775, leaving £279 to be carried forward. The number of passengers carried during the past six months, exclusive of season ticket holders, was 2,307,141, showing an increase of 116,609 over the number carried in the corresponding period of 1901. The season ticket holders on December 31st last numbered 1,243, as against 1,030 at the end of December, 1901. The directors announce that during the past half-year Sir Wyndham S. Portal, Bart., who was chairman of the company from its commencement, and always took great interest in its affairs, has resigned, and Sir Charles Scotter has been elected chairman in his place. Mr. William W. Portal has also retired from the board, and it is not proposed to fill these vacancies at present.

Metropolitan Electric Tramways Co.

THE report of this company for the half-year ended December 31st last, to be presented at the meeting to be held to-day, states that, by resolution of the company in general meeting, held July 1st, 1902, the share capital of the company was increased from £1,000,000 to £1,500,000, divided into 500,000 preference shares, 500,000 ordinary shares and 500,000 deferred shares, all of £1 each. As a result of the proposals made by the British Electric Traction Co., Ltd., to the shareholders of the North Metropolitan Tramways Co. in May last, 78,504 shares in the North Metropolitan Tramways Co. were agreed to be transferred to this company in consideration of the issue by this company of 314,016 fully paid 5 per cent. cumulative preference shares, 314,016 fully paid deferred shares, and 78,504 fully paid ordinary shares of £1 each. The company therefore holds 78,504 out of a total of 110,923 shares in the North Metropolitan Tramways Co. A call of 3s. 6d. per share has been made on 40,750 ordinary shares issued in April and June, making these shares 6s. paid. Five debentures of £100 each have been redeemed, the debentures now outstanding amounting to £29,100. These are redeemable at par on or before February 28th next. The directors propose to make an issue of capital shortly. The balance at credit of this account is £10,424, including the sum of £2,884 brought forward from the previous half-year. The directors recommend that the cumulative dividend on the preference shares at the rate of 5 per cent. per annum be paid for the past year. The dividend for the past half-year will absorb £7,850, leaving a surplus of £2,574. The payment of the preference dividend is guaranteed by the British Electric Traction Co, Ltd, for three years, from January 1st, 1902, but as the preference shares were not issued till the latter part of the year, the payment of a dividend for the first half of the past year was postponed for the publication of the accounts, and it is proposed to issue warrants for the full year's dividend immediately after the general meeting, the balance of £5,276 being advanced by the British Electric Traction Co, L'd., under their guarantee. It is proposed in future to pay an interim dividend on the preference shares on August 15th in each year. The company has purchased 3,500 ordinary shares in the Harrow Road and Paddington Tramways Co. at the price of £22,760, of which £6,760 has been paid, the balance of the purchase price being payable either in debentures or cash on June 30th, 1903. The company has purchased, as from November 26th, 1902, with the approval of the Board of Trade, from the North Metropolitan Tramways Co., about 7½ miles of tramways in the County of Middlesex, and is now working the same by horses. Included in the purchase is the beneficial user of 1 mile of tramway in the County of London belonging to the North Metropolitan Tramways Co. The agreed purchase price is £200,000, which is to be satisfied in part by the company assuming the obligations, both as to principal and interest, of the existing £150,000 3½ per cent. debentures of the North Metropolitan Tramways Co., which are redeemable at par on January 1st, 1909, and as to the balance of £50,000 by payment in cash, with interest at the rate of 4 per cent. per annum from November 26th, 1902. By an Act of Parliament passed in 1897, the date when the several local authorities can purchase the undertaking under the 43rd Section of the Tramways Act, 1870, was extended for a period of 28 years as from 1897. In 1902 another Act was obtained, which authorised the conversion of these tramways to electric traction on the overhead system, and in the case of one of the purchasing authorities, the Urban District Council of Tottenham, the tenure of the tramways was further extended to the year 1930. The County Council of Middlesex has entered into contracts for the construction of 11¼ miles of light railways, part of the large system to be eventually leased to the company by the County Councils of Middlesex and Hertford. The directors propose to enter into contracts for the electrical equipment of these light railways, and also for the conversion to electric traction of the tramways purchased from the North Metropolitan Tramways Co. The directors are contemplating the purchase of all the shares in the North Metropolitan Electric Power Supply Co., which are at present held by the British Electric Traction Co., Ltd. The North Metropolitan Electric Power Supply Co. has secured two Acts of Parliament, which sanction the construction of main power stations, and the supply of electricity in bulk to authorised users and distributors within an area of about 325 sq. miles in the counties of Middlesex and Hertford. These Acts secure to the company rights in perpetuity.

Metropolitan Railway Co.

IN their report for the half-year ended December 31st last, to be submitted at the meeting to-day, the directors say that the British Westinghouse Co., to whom a contract was let in March, 1902, for the supply of the complete generating plant and machinery, as well as the sub-station plant, have taken the contract for the erection of the power station. The building is now in course of construction, and the directors expect it to be completed and equipped with machinery according to the contracts by November 30th next. A contract has been entered into for the construction of new rolling stock, and a number of the corridor trailer cars are now being built. The remainder of the stock will be proceeded with directly the questions relating to the equipment of the motors and the electrical details are settled with the Board of Trade and the other railway companies working over the railway. Negotiations have been revived for a close working union with the Metropolitan District Railway Co., with the object of ensuring uniformity in the equipment of the line for electric traction and working the traffic to the best advantage of both companies. The Harrow and Uxbridge Railway, which will connect this system with the town of Uxbridge, is making satisfactory progress, and the contractors expect to have the new line ready for opening by the end of the year.

Fleetwood and District Electric Light and Power Syndicate.

ON 16th inst. an extraordinary general meeting of this company was held, when a resolution was passed authorising the directors to increase the debentures by £5,000 (5 per cent.). A second resolution was proposed providing that unless the whole sum were applied for the monies should be returned, but after discussion this was not carried. It was stated that during the past year the company had paid its debenture interest, and cleared £400. One speaker said that "they had £28,000 spent, and half the streets of Fleetwood were without mains. They had not a halfpenny of capital to jingle; had empty coal bunkers, and were wanting more machinery."

British Columbia Electric Railway Co.

THE meeting held on 21st inst. at the Cannon Street Hotel was presided over by Mr. G. P. Norton.

In moving the adoption of the report, the CHAIRMAN said the directors now saw their way, he believed, to obtain additional capital as it might be required without the difficulties which had recently been experienced. The Dominion of Canada required the company to make up their accounts to June 30th instead of to April 15th as previously, so they had before them a report and accounts for 15 months instead of 12. In the report the directors stated that it was their intention to recommend the payment of a dividend on the deferred ordinary stock of 4 per cent. per annum for the 15 months ended June 30th. The company's business was increasing again in a manner which had not been anticipated. For the last three months of 1902 their increase had been nearly 2,000 lights per month. This meant that, although their lighting business had increased rapidly in the past, it was increasing at the present time practically at twice the former rate. In view of this fact and of the other expenses, the directors had consulted with the principal holders of the deferred ordinary shares, and it had been though advisable, instead of paying the whole of the dividend he had mentioned in cash, that the 15 months' dividend should be paid in deferred ordinary shares representing the amount, and, further, that on the 28th inst. the usual dividend of 4 per cent. per annum on the deferred ordinary shares should be paid in cash. This, of course, would be an interim dividend.

The Hon. M. R. GIFFORD seconded the motion.

A dividend for the 12 months ended March 31st last of 5 per cent. per annum on the preferred ordinary stock was passed.

Anglo-American Telegraph Co.—The board has resolved, after placing the sum of £12,000 to the credit of the renewal fund for the half-year, to recommend, at the meeting to be held on February 6th, the declaration of the following dividends:—A balance dividend of 18s. per cent. upon the ordinary consolidated stock, £1 15s. per cent. upon the preferred stock, and a first and final dividend of 1s. per cent. upon the deferred stock, for the year ending December 31st, 1902. A balance of about £1,700 will be carried forward. These dividends, together with those already paid, amount to £3 0s. 6d. per cent. on the ordinary consolidated stock, £6 per cent. on the preferred stock, and 1s. per cent. on the deferred stock for the year 1902.

Central London Railway Co.—The directors recommend a dividend for the past half-year of 4 per cent. per annum on the ordinary and preferred stocks, and 4 per cent. for the year on the deferred stock, carrying forward £27,717, and placing £10,000 to the reserve fund. The dividends for the corresponding period of 1901 were at the same rate, with £10,000 placed to the reserve fund and £5,870 carried forward.

Commercial Cable Co.—The company is issuing at par to the shareholders the remaining $1,666,700 of unissued share capital in the proportion of 12½ per cent. of their present holdings to all shareholders. A special meeting is to be held after the annual meeting on March 2nd, for the purpose of discussing the advisability of increasing the authorised capital from $15,000,000 to $25,000,000.

Marconi Wireless Telegraph Co.—Last Tuesday's *London Gazette* contains a lengthy notice respecting certain alterations which it is proposed to make in the articles. The alterations have been approved at extraordinary meetings of the shareholders, and are to form the subject of a petition in the Chancery Division before Mr. Justice Swinfen Eady.

Liverpool Overhead Railway Co.—The accounts for the past half-year show an available balance of £10,138, and the directors have resolved to recommend payment of a dividend at the rate of 5 per cent. per annum on the preference shares, and 1¼ per cent. per annum on the ordinary shares, against 1 per cent. per annum on the shares for the corresponding period last year. Balance carried forward, £4,013.

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—Wednesday, February 4th, British Thomson-Houston Co., Ltd.—£200,000 4½ per cent. first mortgage debenture stock, and has ordered same to be officially quoted.

Westminster Electric Supply Corporation.—Dividend at the rate of 13 per cent. for the half year, making 12 per cent. for the year.

STOCKS AND SHARES.

Wednesday Evening.

CHANGES in the electrical sections are more frequent than usual this week, although none of them are caused to the marking of the securities *ex* dividend. In the railway division the dividend announcements themselves are responsible for the fluctuations which we have to record, and as regards telegraph stocks, the hand of Marconi fights in its course against the hope of proprietors in cable companies. Electricity supply shares keep steadily good, and already there is a talk of what dividends are likely to be paid. Business, if not particularly brisk, is decidedly good, and almost alone amongst their Stock Exchange brethren, the jobbers in these securities have no just cause for complaint on the score of slackness.

Central London stocks relapsed somewhat sharply on the announcement of the dividend, although perhaps readers of these notes were quite prepared for a distribution which seems to have caused disappointment to a good many holders. The Ordinary and the Preferred stocks, it will be seen, are both lower on the week, but the worst of the fall has already been partially recovered, and certain shrewd brokers are recommending the stocks for investment purposes. City and South London Ordinary has recovered its loss of a point, the company's report being considered satisfactory. But the outstanding feature amongst the purely electrical stocks is a rise of 3 in Waterloo and City Ordinary, upon the very unexpectedly good dividend. When the secretary's letter was handed round the market there ensued almost a mild excitement, for everyone seemed astonished at the extra ¼ per cent. being declared. The report is yet better than the dividend.

After many years there dawns a really practical hope that a fusion of interests between the Metropolitan and the Metropolitan District is not merely a mirage. All previous attempts at *rapprochement* have met with dismal failure, but the report of the Metropolitan Railway encourages a new confidence that the eternal bickering of the past is about to give way to a sensible harmony in the future. No doubt early information of this move was responsible for the sharp rise that has lately overtaken Metropolitan Consolidated, and since the publication of the news there has been little change in price, the improvement having been discounted earlier.

The usual annual interest aroused in the Anglo-American Telegraph dividend has been satisfied—we use the word in a limited sense—by the announcement that the Preferred stock will get its full 6 per cent., and that the Deferred proprietors shall be the proud recipients of 1s. per cent. While this is, perhaps, better than some had looked for, that shilling smacks too much of comic opera to advance prices, and possibly if the Deferred dividend had not been declared, the Anglo varieties might have improved a trifle As it is, the two senior issues are both lower. Eastern Preference has receded heavily upon a couple of selling orders, but the Ordinary stays at the reduced level of a week ago. Great Northern and Indo-European are both easier, and weakness has overtaken the West Indian group, it being stated that some of the volcanoes show signs of again becoming active. Taking their cue from Telegraph things in general, the Globe Telegraph and Trust shares have slid back a fraction; in fact, the whole market is emphatically dull and weak, and even Submarine Cables Trust certificates are down five points.

National Telephones, on the other hand, maintain their bracing tone, and although the Third Preference mark a fractional decline, the company's Preferred and 4 per cent. Debenture stocks are each a point higher. Attention may be again directed to the latter security as worth looking into by those who are willing to take a nominal risk for the sake of a steady 4 per cent. return on their capital. There is no change in Telephone varieties other than the National Co.'s.

A first dividend of 2½ per cent. on Smithfield Markets Electric Supply will come as a boon and a blessing to those who have held the shares ever since the company was formed in 1897. The price was quick to respond to the announcement and is ¼ up, no change having occurred in the 4 per cent. Debenture stock. It is rumoured that the South London Co. is about to follow Smithfield's example, and report says that the dividend on the latter has been earned by participation in the profitable cold-storage business.

Metropolitan shares have been marked up 10s., and a little cautious dealing goes on in the Ordinary. At the time of writing the award is not out, and some of the dealers in the market desperately declare that it never will be! New issues are being made by the Folkestone Electric, and possibly by the Hove. It is thought that the latter will probably take the shape of Debenture stock bearing 4 per cent. interest. There is no market in the new Folkestones, but they should of course be taken up by those who have the privilege to subscribe, for they make a capital investment, both as regards present yield and also in view of future developments in this wisely-governed little company.

British Electric Tractions are a good market, showing a rise of 10s. as regards the Ordinary shares, the Preference being unchanged. There is little doing in miscellaneous shares, but Henley's have eased a fraction. It is worth noticing that Edison Debenture stock has improved a shade; the share issues keep merely steady.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations Jan. 21st.	Closing Quotations Jan. 28th.	Business done week ended Jan. 28th, 1903. Highest	Lowest
67,100	African Direct Telegraph, 4 % Debs.	100	..	..	..	96 —100 xd	96 —100	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	..	..	..	2¼— 3⅛	2⅜— 3⅛	..	..
119,700£	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	..	..	..	70 — 80	70 — 80	..	..
788,840	Anglo-American Telegraph	Stock	3½%	6½s.	6d/-	48 — 51	47 — 50	48⅞	48
3,105,580	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	90 — 92	89 — 91	90½	89½
3,105,580	Do. do. do. Deferred	Stock	5s. %	2s.	1/-	7⅞— 8⅛	7⅞— 8⅛	8	7¾
44,000	Chili Telephone, Nos. 1 to 44,000	5	5 %	5 %	..	4 — 4½	4 — 4½	..	..
13,333,300$	Commercial Cable	$100	8 %	8 %	..	170 —180	170 —180	..	..
1,841,209	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	..	..	..	92 — 95	91 — 94	92½	91
16,000	Cuba Telegraph	10	4½%	4 %	..	5 — 6	5 — 6	..	..
6,000	Do. 10 % Pref.	10	..	..	..	13 — 14	13 — 14	..	..
12,931	Direct Spanish Telegraph	5	4 %	4 %	..	2¼— 3½	2¼— 3½	..	..
6,000	Do. do. 10 % Cum. Pref.	5	..	..	..	7 — 8	7 — 8	..	..
60,710£	Direct United States Cable	20	3½%	3½%	..	10 — 10½ xd	10 — 10½	10½	10
92,800£	Direct West India Cable, 4½% Reg. Deb., within Nos. 1 to 1,200, Red.	100	..	..	..	98 —101	98 —101	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	..	112 —117 xd	112 —117	115½	112
1,955,565	Do. 8½ % Pref. Stock	100	..	..	..	89 — 92	85 — 88	86½	85
1,534,645	Do. 4 % Mort. Deb. Stock Red.	Stock	..	..	..	105 —108	105 —108	106	..
800,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	..	10½— 11½	10½— 11½	11	10½
820,000£	Do. 4 % Deb. Stock	Stock	..	..	..	107 —110	107 —110	107	..
800,000	Eastern & South African Tele., 4% Mt. Db., Nos. 1 to 3,000, red. 1909	100	..	..	..	99 —102	99 —102	..	..
200,000£	Do. do. 4 % Reg. Mort. Debs. (Mauritius Sub.) 1 to 8,000	25	..	..	..	99 —102 %	99 —102	..	..
180,227	Globe Telegraph and Trust	10	5½%	5½%	..	8¼— 9	8⅛— 8⅜	8⅜	8⅛
180,042	Do. do. 6 % Pref.	10	..	..	..	13 — 13½	12 — 13	12½	12
150,000	Great Northern Telegraph, of Copenhagen	10	15 %	15 %	..	24 — 24½	24 — 26	24	24½
66,300£	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	..	..	..	98 —101 xd	98 —101	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	..	38 — 42	37 — 41	..	..
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	..	..	..	101 —105	101 —105	..	..
72,680	Montevideo Telephone, Ltd., Ord. Nos. 1 to 72,680	1	..	..	..	1/16— 1/8	1/16— 1/8	..	..
86,492	Do. do. 5 % Pref., Nos. 1 to 86,492	1	..	..	..	½— 1	½— 1	..	..
1,983,333	National Telephone, Pref. Stock	100	5 %	5 %	..	96 — 98	97 — 99	98⅛	97
1,966,667	Do. do. Def. Stock	100	60	64 xd	..	72 — 74	72 — 74	72⅛	72
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	..	13 — 14	13 — 14	13 1/16	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	..	11½— 12½	11½— 12½	..	..
250,000	Do. do. 5 % Non-cum. 3rd. Pref., 1 to 250,000	5	5 %	5 %	..	5⅛— 5⅜	5 — 5⅛	5⅛	5 1/16
2,000,000£	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	..	93 — 96	94 — 96	95⅛	94
600,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	..	99 —103	101 —103	..	..
171,504	Oriental Telephone and Elec. Nos. 1 to 171,504, fully paid	1	6 %	6 %	..	⅞— 1	⅞— 1	..	..
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	..	..	..	97 —100	97 —100	..	..
11,839	Reuter's	8	5 %	5 %	..	6½— 7½	6½— 7½	..	..
3,308	Submarine Cables Trust	Cert.	..	..	..	110 —120	105 —115	..	..
58,000	United River Plate Telephone	5	7 %	7 %	..	5 — 5⅛	5 — 5⅛	..	..
40,000	Do. do. 5 % Cum. Pref., Nos. 1 to 40,000	5	..	..	..	4⅛— 5	4⅛— 5	..	..
179,947£	Do. do. 5 % Debs.	Stock	..	..	..	100 —103	100 —103	..	..
15,609	West African Telegraph, Shares	10	..	..	..	3 — 4	3 — 4	..	..
30,008	West Coast of America, Nos. 1 to 30,000 and 53,001 to 53,008	2½	..	..	..	0 — ¼	0 — ¼	..	..
150,000£	Do. do. 4% Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	..	..	..	96 — 99	96 — 99	..	..
267,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	..	11 — 11½	10⅞— 11⅛	11⅛	10⅞
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	..	..	..	100 —103	100 —103	..	..
400,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	97 —100	97 —100	..	..
88,321	West India and Panama Telegraph	10	1½%	..	..	⅝— ⅞	⅛— ⅜	..	..
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	..	..	..	4⅛— 5⅛	4⅛— 5⅛	4⅜	..
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	..	..	..	3 — 4	2⅛— 3⅛	..	..
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	..	..	..	98 —101 xd	98 —101	97	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

20,000	British Aluminium 7 % Cum. Pref.	10	5½%	..	..	3 — 4	3 — 4	..	..
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	..	..	..	75 — 80	75 — 80	..	..
100,000	British Electric Traction	10	9 %	9 %	..	12½— 13	13 — 13½	13 5/16	12⅝
100,000	Do. do. 6 % Cum. Pref.	10	..	..	..	12 — 12½	12 — 12½	12 5/16	12
600,000£	Do. do. 5 % Perpetual Debenture Stock	Stock	..	..	..	124 —127	124 —127	125	..
100,000	British Insulated Wire Ord.	5	15 %	10 %	..	7⅛— 8	7⅛— 8	..	..
100,000	Do. do. 6 % Cum. Pref.	5	..	..	..	5⅞— 6⅛	5⅞— 6⅛	..	..
50,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	..	..	..	104 —108	103 —107	..	..
50,000	¶Browett, Lindley & Co. (1899), Ord.	£1	8 %	..	..	12/6 to 13/6	12/6 to 13/6	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	6 %	..	..	16/6 to 17s.	16/6 to 17s.	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	5 %	Nil	..	¾— 1⅛	¾— 1⅛	..	..
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	3 %	..	1 — 1⅛	1 — 1⅛	..	..
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	..	..	..	100 —103	100 —103	..	..
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	..	..	..	91 — 96	91 — 96	..	..
35,000	Callender's Cable Construction shares	5	15 %	20 %	..	14 — 15	14 — 15	..	..
40,000	Do. do. do. 5 % Cum. Pref.	5	..	..	..	5⅛— 6	5⅛— 6	5⅛	..
90,000£	Do. do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	..	..	..	108 —112	108 —112	..	..
1,860,014	Central London Railway, Ord. Stock	Stock	..	4 %	4 %	111 —114	108 —111	110	109
494,093	Do. do. 4 % Pref. Stock	Stock	..	4 %	4 %	105 —108	105 —108	108	106½
494,993	Do. do. Def. do.	Stock	..	4 %	4 %	115 —118	113 —116	114	..
1,330,000	City and South London Railway	Stock	1½%	2 %	3⅛%	75½— 76½	76½— 77⅛	77⅛	76½
85,000	Crompton & Co., Nos. 1 to 85,000	3	8 %	7½%	..	2⅝— 3 xd	2⅝— 3	2⅝	..
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red.	..	..	..	..	101 —106%	101 —106 %	..	..
99,261	Edison & Swan United Elec. Light, "A" shares, £3 paid, 1 to 99,261	5	2½%	..	..	⅛— ⅜	⅛— ⅜	..	..
17,139	Do. do. "A" shares, 01—017,139	5	2½%	..	..	1½— 2⅛	1½— 2⅛	..	..
344,023£	Do. do. 4 % Deb. Stock Red.	100	..	..	..	73 — 77	74 — 78	..	..
100,000£	Do. do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	..	..	..	77 — 82	77 — 82	..	..
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	..	1½— 2	1½— 2	..	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	..	..	..	2⅛— 3	2⅛— 2⅝	..	..
182,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock	Stock	..	..	..	97 —100 xd	99 —102	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	..	10 — 10½	10 — 10½	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	..	..	..	100 —103	100 —103	..	..
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	20 %	20 %	..	16½— 17½	16 — 17	..	..
35,000	Do. do. 4½ % Pref.	5	4½%	..	..	5⅛— 5⅜	5⅛— 5⅜	..	..
48,050	Do. do. 4½ Mort. Deb. Stock	Stock	..	..	..	109 —113	109 —113	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works	10	10 %	10 %	..	19 — 20	19 — 20	19½	19⅛
300,000£	Do. do. do. 4 % 1st Mort. Deb.	100	..	..	..	101 —104	101 —104	103½	..
37,500	†Liverpool Overhead Railway, Ord.	10	3½%	1½%	..	5⅜— 5⅞	5⅜— 6	..	..
10,000	† Do. do. Pref. £10 paid	10	..	..	..	9⅞— 10⅛	10⅛— 10⅞	..	..
7,509	Parker (Thomas), Ltd., Ord., Nos. 1 to 7,500	10	..	..	..	14½— 15½	14⅜— 15½	..	..
	§Rosling & Fynn 6 % Cum. Pref.	£1	6 %	..	..	.. — ..	.. — ..	..	..
37,350	Telegraph Construction and Maintenance	12	17½%	20 %	..	37 — 40	37 — 40	39	37⅜
150,000£	Do. do. 4 % Deb. Bds., Nos. 1 to 1,500 Red. 1909	100	..	..	..	101 —104	101 —104	..	..
540,000£	Waterloo & City Railway, Ord. Stock	100	3 %	3 %	3⅛%	94 — 97	97 —100	98	97

† Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid.
§ From Bradford Share List.
¶ From Manchester Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, ⅞—1.
National Electric Free Wiring, ½—1.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 13—14.
Do. do. Pref. (£10 pd.), 10—11.

Bank rate of discount 4 per cent. (October 2nd, 1902).

SHARE LIST OF ELECTRICAL COMPANIES (*continued*).—ELECTRICITY SUPPLY COMPANIES.

Present issue.	NAME.	Stock or Share.	Dividends for the last three years. 1900.	1901.	1902.	Closing Quotations Jan. 21st.	Closing Quotations Jan. 28th.	Business done week ended Jan. 28th, 1903. Highest.	Lowest.
		‡							
100,000	Blackheath and Greenwich Dist. Electric Light, Ord...	1	..	..	..	⅜— ⅝	⅜— ⅝	..	..
100,000	Do. 4½% 1st Deb. Stock, Prov. Certs. ..	100	..	..	..	110 —113	113 —116	..	..
20,000	Brompton & Kensington Electric Light Sup., Ord., 1 to 20,000 ..	5	6 %	8 %	..	10¼ — 10⅜	10¼ — 10⅜	..	..
20,000	Do. do. 7 % Cum. Pref. ..	5	..	..	..	10 — 10⅛	10 — 10⅛	..	..
50,000	Charing Cross and Strand Electricity Supply	5	9 %	10 %	..	9⅛ — 10	9⅛ — 10	9⅛	9⅛
70,000	Do. do. do. 4½% Cum. Pref. ..	5	..	..	..	5¾ — 6	5¾ — 6	..	..
40,000	Do. do. "City Undertaking" 4½% Cum. Pref. ..	5	..	..	..	4¾ — 5⅛	4¾ — 5⅛	4⅞	..
250,000	Do. do. 4 % Deb. Stock Red.	100	..	..	..	103 —105	103 —105	..	..
44,486	*Chelsea Electricity Supply, Ord.	5	5⅛%	4 %	..	5 — 5⅛	5 — 5⅛	5⅝	5⅛
150,000‡	Do. do. % Deb. Stock Red.	Stock	..	..	..	108 —111	108 —111	110½	..
70,595	City of London Electric Lighting, Ord. 40,001—110,595 ..	10	0 %	5 %	..	10 — 11	10 — 11	10⅝	10⅜
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	..	..	13½ — 14½	13½ — 14½	..	..
400,000‡	Do. 5 % Deb. Stock, Scrip. (iss. at 115) all paid	..	..	..	..	122 —127	122 —127	..	..
300,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	..	..	..	102 —105	102 —105	104½	..
40,000	County of London & Brush Prov. Electric Lighting, Ord. 1—40,000..	10	4 %	4 %	..	8½ — 9½	8½ — 9½	9⅝	8⅞
20,000	Do. do. do. 6 % Pref., 40,001—60,000..	10	6 %	..	..	12 — 13	12 — 13	..	..
400,000‡	Do. do. 4½% Deb. Stock, Prov. Certs. (all paid) Red	..	..	..	..	107 —110	107 —110	108½	107
50,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	..	6½ — 7 xd	6½ — 7	6⅞	6⅝
30,000	Do. do. 6 % Cum. Pref.	..	..	..	..	6 — 6½	6 — 6½	6⅞	..
140,000	Do. do. 4½% 1st Mort. Deb. Stock ..	100	..	..	..	105 —108 xd	105 —108	107	..
21,000	Kensington and Knightsbridge Electric, Ord.	5	12 %	10 %	..	10 — 11	10 — 11	10⅛	..
90,000	Do. do. do. 4 % Debenture Stock ..	Stock	..	..	..	101 —104	101 —104	..	..
110,000	ondon Electric Supply Corporation, Limited, Ord.	3	..	..	..	1⅞— 2⅛	1⅞— 2⅛	..	..
49,840	Do. do. do. 6 % Pref.	5	..	..	..	5 — 5⅛	5 — 5⅛	5⅛	5⅛
250,000‡	Do. do. do. 4 % 1st Mort. Deb. Stock Red	Stock	..	..	..	96 — 99	96 — 99	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	10	6 %	6⅜%	..	16½— 17½	17 — 18	17⅜	17
220,000‡	Do. do. 4½% 1st Mort. Deb. Stock	..	..	..	..	107 —112	107 —112	..	..
250,000‡	Do. do. 3½% Mort. Deb. Stock Red	Stock	..	..	..	98 —101	98 —101	98½	..
10,852	Notting Hill Electric Lighting	10	7 %	6 %	..	14 — 15	14 — 15	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14⅜%	14⅜%	14⅜%	14½— 15½	14½— 15½	..	..
20,000	Do. do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	..	8½ — 9½	8½ — 9½	..	..
150,000‡	Do. do. do. 3½% Deb. Stock Red ..	100	..	..	..	97 —100	97 —100	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	..	..	..	2 — 2⅛	2⅛— 2⅜	2⅛	..
50,000‡	Do. do. 4% Deb.	100	..	..	..	80 — 90	80 — 90	..	..
65,000	South London Electricity Supply, Ord.	5	..	..	..	3 — 3⅛	3 — 3⅛	..	..
30,000	Urban Electric Supply, Ord.	5	..	..	..	4⅞— 5⅛	4⅞— 5⅛	5	..
30,000	Do. do. 5 % Cum. Pref.	5	..	..	..	4⅞— 5⅛	4⅞— 5⅛	..	..
110,000	Westminster Electric Supply, Ord.	5	10½%	10½%	12 %	11⅜— 12⅛	11⅜— 12⅛	11⅛	11⅛
28,141	Do. do. 5 % Cum. Pref.	5	..	..	..	6 — 6⅛ xd	6 — 6⅛	6⅛	..

*Subject to Founders Shares. ‡ Unless otherwise stated all shares are fully paid.

MARKET QUOTATIONS, Wednesday, January 28th.

CHEMICALS, &c.

		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a ,, Nitric	per cwt.	22/-	22/-	..
a ,, Oxalic	per cwt.	32/-	32/-	..
a ,, Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	42/-	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	£33 10	..
a ,, ,, ...	per ton	£30	£30	..
a Bleaching powder	per ton	£4 10	£4 10	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£13	£13	..
a Benzole (90 %)	per gal.	7/-	7/-	..
a ,, (50/90 %)	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£19 10	£19 10	..
a Lead, Nitrate	per ton	£24	£24	..
a ,, White Sugar	per ton	£31	£31	..
a ,, Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks ..	per lb.	3d.	3d.	..
a ,, Caustic (75/80%).. ..	per ton	£24	£24	..
a ,, Bisulphate	per ton	£35	£35	..
a Shellac	per cwt.	125/-	125/-	..
e Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 5	£6 5	..
a ,, Recovered	per ton	£5 10	£5 10	..
a ,, Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a ,, Crystals	per ton	£3	£3	..
a ,, Bichromate, casks.. ..	per lb.	2½d.	2½d.	..

METALS, &c.

b Aluminium Ingots, in ton lots ..	per ton	£148	£148	..
b ,, Wire, in ton lots ..	per ton	£224	£224	..
b ,, Sheet, in ton lots ..	per ton	£191	£191	..
p Babbitt's metal ingots	per ton	£40 to £130	£40 to £130	..
c Brass (rolled metal 2" to 12") basis	per lb.	6¾d.	6¾d.	..
c ,, Tube (brazed)	per lb.	8¼d.	8¼d.	..
c ,, ,, (solid drawn).. ..	per lb.	7¾d.	6¾d.	..
c ,, Wire, basis..	per lb.	6¾d.	6¾d.	..
c Copper Tubes (brazed)	per lb.	8¼d.	8¼d.	¼d. dec.
c ,, ,, (solid drawn) ..	per lb.	8¾d.	9d.	¼d. dec.
g Copper Bars (best selected ..	per ton	£67	£67	..

METALS, &c. (*continued*).

		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£67	£67	..
g ,, Rod	per ton	£67	£67	..
e ,, (Electrolytic) Bars ..	per ton	£59	£59	..
e ,, ,, Sheets ..	per ton	£73	£73	..
e ,, ,, Rod ..	per ton	£63	£63	..
e ,, ,, H.C. Wire	per lb.	7¾d.	7¾d.	¼d. inc.
f Ebonite Rod	per lb.	3/-	3/-	..
f ,, Sheet	per lb.	5/-	5/-	..
n German Silver Wire	per lb.	1/4½	1/4½	..
h Gutta-percha fine	per lb.	8/-	8/-	..
h India-rubber, Para fine	per lb.	3/8 to 3/9	3/8 to 3/10½	dec.
i Iron, Charcoal Sheets	per ton	£18	£18	..
i ,, Pig (Cleveland warrants)	per ton	47/6½	47/3½	3d. inc.
i ,, Forgings, according to size	per ton	From £11	From £11	..
i ,, Scrap, heavy	per ton	47/6 to 50/-	47/6 to 50/-	..
i ,, Wire, galvanised No. 8 ..	per ton	£9 15	£9 15	..
g Lead, English Ingot	per ton	£11 12 6 to £11 15	£11 15 to £11 17 6	2s. 6d. dec.
g ,, ,, Sheet	per ton	£18	£18	..
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£8 2 6	£8 12 6	..
d Mica (in ginal cases) small ..	per lb.	3d. to 9d.	3d. to 9d.	..
d ,, ,, ,, medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d ,, ,, ,, large ..	per lb.	3/3 to 7/3	3/3 to 7/3	..
p Phosphor Bronze, plain castings	per lb.	11¼d. to 1/2	11¼d. to 1/2	..
p ,, rolled bars & rods	per lb.	1/- to 1/3	1/- to 1/3	..
p ,, ,, strip & sheet	per lb.	From 1/2	From 1/2	..
o Platinum	per oz.	£4	£4	..
p Silicium Bronze Wire	per lb.	9d. to 1/-	9d. to 1/-	..
i Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	£58	..
i ,, ,, in bars		From £15	to £40	..
g Tin, Block	per ton	£133 to £134	£130 10 to £131 10	£2 10 inc.
g ,, Foil	per lb.	1/6	1/6	..
n ,, Wire, Nos. 1 to 16	per lb.	1/7½	1/7½	..
p White Anti-friction Metals—				..
"White Ant" brand ..	per ton	£36 to £60	£36 to £60	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	7d.	7d.	..
j ,, 6 lea. Flax	per lb.	5¾d.	5¾d.	..
j ,, 3 ply 10 lbs. Russian ..	per lb.	4⅛d.	4⅛d.	..
j ,, 10 lbs. Russian, single ..	per lb.	4¼d.	4¼d.	..
j ,, 180 lbs. Jute rove ..	per ton	£11	£11	..
k Zinc, Sh't (Vieille Montagne bnd.)	per ton	£23 10	£23 10	..

Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons., Ltd. d Messrs. F. Wiggins & Sons. e Messrs. Frederick Smith & Co.

Quotations supplied by { f India-Rubber, G.P. and Teleg. Works g Messrs. James & Shakspeare. [Co., Ltd. h Messrs. Edward Till & Co. i Messrs. Bolling & Lowe. j Messrs. Walter H. Hindley & Co., Ltd.

Quotations supplied by { k Messrs. Morris Ashby, Limited. m Messrs. W. T. Glover & Co., Ltd. n Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd. p The Phosphor Bronze Company Ltd.

TRAFFIC RECEIPTS.

Company.	Week ending	Receipts for the week. Am'nt.	Inc. or dec.*	Total to date. Am'nt.	Inc. or dec.*	Miles open. This year.	Last year.
		£	£	£	£		
Blackburn Corp. Trys. ..	Jan. 23	629	+ 21	35,040	+ 4,365	12¼	13¼
Blackpool and Fleetwood	,, 24	164	+ 3	624	+ 39	7¾	7¾
Bristol Trys. & Car. Co.	,, 23	4,116	+156	—	—	28	28
British Elec. Trac. Co.:—							
Barnsley District ..	,, 16	145	—	334	—	—	—
Devonport	,, 16	371	— 28	870	— 123	5	5
Dudley—Stourbridge..	,, 16	631	+ 32	1,475	+ 43	18¾	18¾
Gateshead	,, 16	721	+135	1,806	+ 312	10½	9½
Gravesend—Northfleet	,, 16	168	—	385	—	3¾	—
Greenock—Pt. Glasgow	,, 16	326	+ 26	936	+ 69	7¾	7¾
Hartlepool	,, 16	187	+ 30	467	+ 42	6¾	4¼
Kidderminster	,, 16	92	+ 1	219	+ 2	4¼	4¼
Merthyr	,, 16	158	— 18	356	— 65	3	3
Middleton	,, 16	214	—	531	—	8¼	—
Oldham—Ashton ..	,, 16	487	+ 49	1,150	+ 56	8	8
Poole	,, 16	210	+ 30	474	+ 36	8¾	8¾
Potteries	,, 16	1,410	+ 46	3,250	+ 50	28¾	28¾
Rothesay..	,, 16	29	+ 6	118	+ 35	—	—

Company,	Week ending	Receipts for the week. Am'nt.	Inc. or dec.*	Total to date. Am'nt.	Inc. or dec.*	Miles open. This year.	Last year.
		£	£	£	£		
B.E.T. Co. (*continued*)—							
Southport	Jan. 16	196	+ 83	485	+ 195	5¾	5¾
South Staffordshire ..	,, 16	594	— 94	1,498	— 246	21¾	22¾
Swansea	,, 16	455	+ 80	1,014	+ 65	5¾	5¾
Taunton	,, 16	42	— 5	107	— 19	1¾	—
Tynemouth	,, 16	169	— 1	432	— 21	3¾	3¾
Weston-super-Mare..	,, 14	23	—	48	—	2¾	—
Wolverhampton Dist.	,, 16	299	+145	696	+ 389	10¾	2¾
Central London Railway	,, 24	6,776	+160	27,672	+ 1,476	6	6
City and S. London Ry.	,, 25	3,367	+458	13,678	+ 1,622	6¼	6¼
Doncaster Corp. Trys. ..	—	—	—	—	—	5¾	—
Dover Corporation Trys.	,, 24	169	— 1	604	— 45	3	3
Dublin United Trys. ..	,, 23	4,165	+121	13,671	— 139	46	46
East Ham Tramways ..	,, 24	424	+110	—	—	5	4¾
Glasgow Corp. Trys. ..	,, 24	11,629	+989	415,909	+ 2,801	62	59¾
Liverpool Overhead Ry.	,, 25	1,454	+111	5,893	+ 298	6¾	6¾
Newcastle Corp. Trys. ..	,, 24	2,910	—	—	—	25	—
Sunderland Corp. Trys.	,, 25	934	— 28	—	—	17¾	17¾

* Compared with the corresponding period of 1901.

THE BUCKINGHAM LONG-DISTANCE PAGE-PRINTING TELEGRAPH.*

(*Concluded from page* 160.)

FIGS. 4, 5, 6, 7 show details of the receiving, unison and printing apparatus. The main line polarised relay and the apparatus which it directly controls are shown in fig. 4. Its armature controls two branch circuits, in which are the sunflower escapement magnet, a unison magnet, and a governing relay. These have each two coils reversely wound, and in the case of the escapement magnet, the effect is to oscillate its armature from side to side in common with the armature of the main line relay. The unison magnet is polarised, and its coils are so connected that a current through one of its coils corresponding to a negative current on the main line tends to assist the induced magnetism, while a current in the other coil (corresponding to a positive current on the main line) opposes the induced magnetism of the magnet. The adjustment of the retractile spring of the magnet is such, that its armature will not be attracted by short pulsations of either polarity, nor by prolonged positive pulses, but it will be attracted by prolonged negative currents. The result of this is that when short and long positive and short negative currents are coming over the main line, the hook on the end of the armature of the unison magnet is always in the path of the teeth of the unison wheel, on the same shaft as the escape-wheel; but when a long negative pulse is received, the armature is attracted, and the hook is withdrawn from the path of the teeth. The space between any two of the teeth on the unison wheel is equal to the space between any three of the teeth on the escape-wheel. Six pulses of current will move the escape-wheel a distance of three teeth. Hence six pulses will also move the unison-wheel a distance equal to that between two of its teeth. Therefore, so long as the escape-wheel is in unison with the received pulses of the latter, the hook will always be drawn out of the path of the teeth,

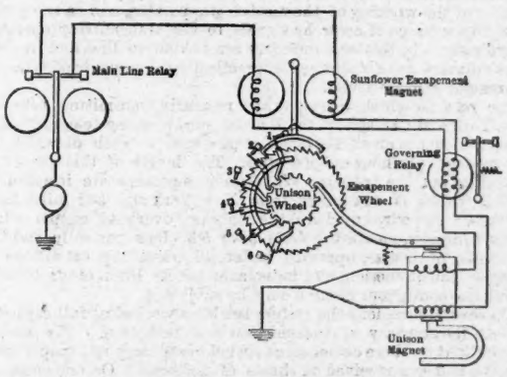


FIG. 4.—DIAGRAM OF RECEIVING APPARATUS.

since each letter of the Buckingham alphabet is followed by a long negative pulse, and if at any time the apparatus should get out of unison, it is seen that in this way five short pulses will hold it at the unison or zero point, as previously stated.

The teeth of the unison wheel also perform another important office. There are six circuit-closing levers, pivoted as shown, of which five

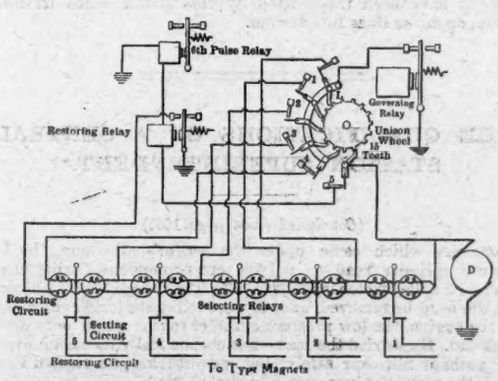


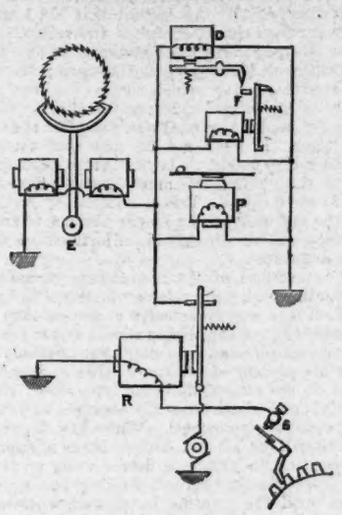
FIG. 5.—DIAGRAM OF UNISON AND SELECTING APPARATUS.

are on one metal support; the sixth is insulated therefrom. The arrangement of these levers relative to the teeth is such that when the unison wheel moves a distance equal to the space between two of its teeth, these levers close their respective circuits at 1, 2, 3, 4, 5, 6 in quick succession, beginning at 1. In other words, each cycle of six pulses, whether of long or short duration, will bring about a consecutive closing of the circuits controlled by these levers

* Abstract from the *Electrical World and Engineer*.

for a purpose presently to be mentioned. Of course, a long pulse will cause a circuit-closer to dwell longer on its contact than a short pulse.

The retractile spring of the governing relay is so adjusted that its armature will not respond to short pulses of current, but will respond to prolonged pulses of either polarity. This feature is utilised in connection with the circuit-closers of the distributor, or sunflower, and certain relays, termed selecting relays, of which there are five,



D, Dogging magnet; F, Ink ribbon feed; P, Press magnet; E, Printer's escape magnet: R, 6th pulse relay.

FIG. 6.—DIAGRAM OF PRINTING CIRCUITS.

shown in fig. 5. These relays, known as Nos. 1, 2, 3, 4, 5, also have two coils, reversely wound. The circuit from one of the coils of each relay is connected to the correspondingly numbered contact post of the sunflower, but this circuit, it may be seen, can only be fully completed when the armature of the governing relay is attracted. Each of the selecting relays, by its armature, controls an electro-magnet, which latter, by its armature, mechanically moves a lever that is connected with the type-wheel moving devices. These are termed the type-wheel magnets.

Whenever, in the course of the incoming six pulses that represent and print a character, one or more of the pulses are prolonged, there will, of course, also be a prolonged pulse or pulses in the local circuit of the governing relay, which will attract its armature, as in fig. 5. Assume, for example, it is the first pulse. At this moment circuit-closing lever 1 is on a tooth of the unison wheel, and its circuit is closed at the contact post 1. Hence, at this instant (the

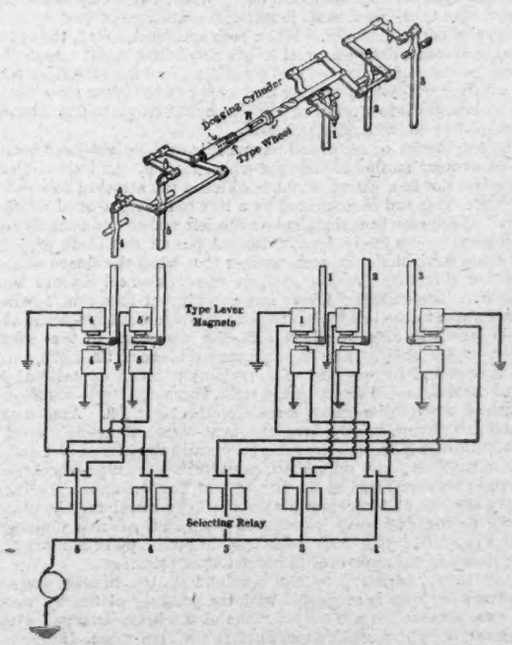


FIG. 7.—TYPE-WHEEL MOVING MECHANISM.

governing relay also being closed) the circuit of No. 1 selecting relay is completed, and being thereby actuated by current from dynamo D, throws its armature to the right, operating a type-magnet No. 1. This magnet, by its armature levers, will move the type-wheel into

a position for printing the letter A, and if there be no other prolonged pulses in the cycle up to the sixth pulse that letter will be printed by the sixth pulse. Had the third and fifth pulse of the cycle also been prolonged, the third and fifth selecting relays would have been operated, with the result that the letter K would have been printed.

The sixth circuit-closing lever is the last to act (it may be said to be the first and last, for it rests normally against its contact point, but it leaves it at practically the instant that No. 1 makes its contact). This lever, when closed, energises two relays, one of which, the sixth pulse relay, operates the press-magnet, the feed-magnet, an ink-ribbon magnet and a dogging magnet; the other is the restoring or resetting relay, which closes the restoring circuit through the selecting relays and type-wheel magnets, and thus resets those instruments to normal position after the selection and printing of a letter. It need not be said that these operations follow each other very quickly. It is obvious that the apparatus operated by the sixth pulse relay must operate before the restoring apparatus performs its part. This is ensured by giving the armature lever of the restoring relay a longer distance to travel before it makes its contact, and also by suitable adjustment of the retractile springs of the armatures.

The circuit connections of the instruments operated by and in connection with the sixth pulse relay are outlined in fig. 6.

The ink-ribbon feed magnet actuates a step-by-step ratchet and pawl device which moves the inking ribbon under the type-wheel. The dogging magnet plays an important part in steadying the type-wheel during the process of printing. This it does by means of a small cylinder on the same shaft as the type-wheel, on the surface of which cylinder 32 small holes are arranged to correspond with the characters on the type-wheel. When the dogging magnet is operated, which will be after a desired letter is approximately in the printing position, its armature drives a dog or pin into one of these holes, thereby adjusting and locking the type-wheel in a given position until the printing is effected, whereupon it is released. The printer escapement magnet operates or controls the train of gearing, which results in feeding the paper around and along its support, as already explained.

The manner in which the type-wheel is brought into any one of the 32 possible positions, considered aside from the alphabet, is, perhaps, the most unique of the numerous novel features of the Buckingham printer.

The electro-mechanism for this purpose is schematically outlined in fig. 7. The type wheel is securely mounted with the dogging cylinder on a horizontal shaft. This shaft receives an endwise motion from the horizontal levers on the left, and a rotary motion from those on the right. In shop phrase, these horizontal levers are termed whiffletrees. The vertical arms 4, 5, connected with type-lever magnets 4, 5, move the horizontal levers which give the endwise motion to the type-wheel. The arms 1, 2, 3 move the right-hand levers which impart by suitable intervening mechanism the rotary motion to the type-wheel. The whiffletrees are connected by suitable links and pins to their respective arms, and are so pivoted and interlinked that a movement of arm 5, for example, to the right will move the type-wheel (whose shaft is attached by a swivel connection to the left-hand levers) a distance equal to the width of one of the type-wheel rings to the left. When arm 4 only is moved, it shoves the type-wheel shaft lengthwise a distance of two rings of the type-wheel to the right. When both arms are moved, the type-wheel is moved a distance equal to one ring to the right. As in the normal position of the type-wheel the second ring from the right is in the printing position, it is clear that either of the other three rings may be brought into a printing position by the single and combined effects of two endwise adjusting arms.

The lengthwise or reciprocal movements of the right-hand levers impart a rotary motion to the type-wheel shaft by the intermediary of a spiral slot in a sleeve through which a pin attached to a rod B projects. This rod is connected by a link to the right-hand whiffletrees. The type-wheel shaft enters the left end of the same sleeve, in which it moves freely lengthwise. A pin on this shaft projects through a straight slot in such manner that when the sleeve rotates in either direction the pin compels the type-wheel shaft to turn with it. The rotating levers are so adjusted that arm 1, when moved alone to the left by its magnet, will turn the type-wheel as a whole one-half of a revolution in the direction of the arrow shown at the shaft. Arm 2, when moved alone to the right, turns the type-wheel two-eighths of a revolution in an opposite direction. Arm 3, moved alone to the right, turns the type-wheel one-eighth of a revolution in the same direction as arm 2. Arms 2 and 3, acting together, jointly turn the type-wheel three-eighths of a revolution in a direction opposite to the arrow, while arms 1 and 2, acting together, but oppositely, will turn the type-wheel two-eighths of a revolution in the direction of the arrow; and by these means any one of the characters on the type-wheel may be placed in the position for printing with a maximum of five prolonged pulses apart from the final prolonged negative pulse for printing and restoring the apparatus to normal after printing.

The press magnet is at the rear end of the tubular support. Its armature lever is connected with the printing platen by means of a rod attached to a crank lever, the platen being arranged within the tube, and driving the paper against the type-wheel through an opening in the tube.

As already noted, the method of transmitting messages by the Buckingham system is identical with that of the Wheatstone automatic telegraph system.

The speed of the operators in preparing messages by the Buckingham keyboard perforating machine for transmission by the Buckingham system, has increased with the increased skill of the operators, and is now not less than 80 words per minute. This rate of speed, it may be said, is greater than that at which the most expert operator of a typewriter could transcribe the same messages on ordinary page copy by the Remington or other typewriter. This is due to the fact that the operator of the Buckingham keyboard perforator has practically no sheets to change, the paper strip coming in rolls sufficient for 100 messages. Furthermore, the extent of depression of the key levers of this machine is less in point of distance travelled than the levers of the ordinary typewriter, and it is easier to operate, since it has practically no friction to overcome, and no work to do other than to close the circuits of the punching and feed magnets. All the business transmitted by the Buckingham system is prepared by this keyboard perforator, and it may be added that two-thirds of all the business transmitted over the regular Wheatstone automatic circuits from the New York office is also prepared by this keyboard perforator, it being understood that it is only a question of arranging the proper combination of stirrups under the key levers to adapt this keyboard perforator to any dot and dash alphabet; the piano wires, feed and punch magnets remaining unchanged.

In the operation of receiving messages by this system an attendant places the telegraph blank in its tubular form over its support, until it meshes with the star-wheel, as stated, to facilitate which a slot at right angles to the circumferential grooves is provided (*n*, fig. 3).

The reception of message then proceeds. At the end of the first line, which contains the number, originating station and date of message, also at the end of the address and at the end of the message, a blank space is provided in the perforated strip at the transmitting end. At these intervals the attendant operates a manual device and advances the paper one line. At all other times the line space movement is automatic. When the message is completed the attendant opens up the paper tube by running a knife-point through the row of perforations on the margin, when the message is ready for delivery.

An expert attendant quickly detects any imperfect signals, such as might be caused by wire trouble of any kind, by a break in the rhythm of the working of the receiving apparatus, and in the event of any appearance of error he signals to the transmitting operator accordingly. In this way incipient errors due to line and instrument troubles are detected with practically the same facility as on the regular Morse circuits.

The rate at which messages are regularly transmitted between New York and Chicago by the Buckingham printing-telegraph on a duplex circuit is about 100 average messages in each direction, or 200 messages per hour on one wire. The length of this circuit is 974 miles, but the ordinary Wheatstone repeaters are inserted at Buffalo, which is 444 miles from New York and 532 miles from Chicago. The wires used are the ordinary overhead copper wires of the company, measuring from 3 to 5·5 ohms per mile, and the system is, of course, operated under all prevailing conditions of capacity, self-induction, and inductance effects from other lines to which the contiguous circuits may be subjected.

On several occasions the system has been worked at full capacity, to test its accuracy of transmission and reception. The matter transmitted on these occasions consisted of ordinary newspaper press reports, and was received on sheets of foolscap. On one occasion, from Chicago to New York, 2,429 words were transmitted in 23 minutes 54 seconds. On another 6,073 words were sent and received in 60 minutes and 13 seconds. On still another occasion 9,126 words were sent in 91 minutes and 18 seconds, all without an error in the printed copy. This is at an average rate of 100 words per minute. These figures include the time lost in changing the sheets, which, at the date of the tests, required six seconds for each change. By an improvement in the apparatus this time has been reduced to one second. It is estimated that over 1,500,000 messages have been transmitted by this system since its introduction upon the lines in question.

THE QUALIFICATIONS OF A CENTRAL STATION SUPERINTENDENT.*

(*Concluded from page* 167.)

In one case which came under the writer's attention, the low-pressure cylinder head on a large cross-compound Corliss engine developed a flaw which made it unsafe. The superintendent directed that the head be removed, and, disconnecting the head end links, he ran the engine, the low pressure cylinder taking steam only on the crank end. He carried the load—not economically, not even evenly, and perhaps not over safely, but, nevertheless, he carried it, and saved the plant the ignominy of a shut down.

It is obvious that for one man to give his individual attention to all the intricacies of the management of a large power house will be utterly impossible without a system of some kind, and the system employed by the superintendent in collecting data and the use he makes of it, is an exceedingly good measure of his ability. The better the superintendent, the more admirable and thorough his system to obtain information. Every employé should have some kind of a record to keep, whereby he turns into the superintendent full information as to what has happened in his department during each run, and suitable methods of classification and comparison are

* The *Central Station* (New York).

absolutely essential. Load curves at at least 15-minute intervals and preferably closer time on interesting peaks should be daily determined, plotted and recorded. The voltage and boiler pressure records should be daily taken and compared by suitable instruments. It is not at all out of place for the superintendent to make a fad of collecting curves of the various quantities tangible and intangible which vary in his station during the lapse of time. The writer has seen men who carried it to the extent of plotting oil, and even waste curves as a part of the determination of the consumption of supplies, and these curves were not taken simply to satisfy curiosity, but the peaks, hollows, and average height above the axis were carefully noted and strict accounting was required.

A good superintendent should establish a system of collecting information relative to his plant, such that though he may not have the actual specific information concerning a given point in his mind, he can at once turn to it and determine perhaps better than the man actually concerned in the incident, what happened, and why it happened.

Lamps, motors, and other consuming devices placed on the circuits of a central station should be of supreme interest to the central station superintendent. He should personally acquaint himself with every motor installation on his line, and should find out and recommend the motors best suited to the work, particularly if his circuits are mostly alternating. An inefficient motor means large meter bills and dissatisfied consumer. In alternating current work it is perfectly possible for a very good motor to act very badly on circuits of a wave form different from that for which the motor was designed—a prolific cause of dissatisfied consumers. It is better to sell 1,000 KW.-hours each to two satisfied consumers than 2,000 KW.-hours to a dissatisfied consumer, and it is therefore a superintendent's best policy to recommend and assist in the purchase and manipulation of economical lamps and motors.

The alternating motor question is becoming particularly serious and it is not sufficient that a motor be of high efficiency. It must possess a high power factor also. The superintendent must appreciate that a wattless load differs from a working load only in the fact that it burns no coal and pays no money. It is even more troublesome to carry than an equivalent working current load, for it imposes the same losses and has a more determined effect on the regulation. Furthermore it limits the capacity of the machine just the same as working load. He should therefore regulate as far as lies in his power the character and number of motors and arc lamps installed on his alternating current lines.

Concerning incandescent lamps, similar remarks apply. He should recommend and influence as far as lies in his power the installation of as high efficiency lamps as it is possible for his station regulation to permit of, and conversely he should improve his regulations to the highest degree in order to permit the use of such lamps. Efficient lamps while they mean low meter bills, mean also an increased number of satisfied consumers. He will ultimately sell more power and keep peace in his family if he adopts these tactics. Moreover, if he sells lamps and motors to his consumers, his company will acquire what profit there is between wholesale and retail prices, and with complaining consumers who do not use economical lamps and motors, he will have the best side of the argument on the size of the meter bills. He should be scrupulously careful that his meters accurately measure the power consumed. The old adage "Honesty is the best policy," applies, and it pays to go to a considerable expense to be sure of honesty.

Assuming that the problem of electrical distribution has been satisfactorily settled, there remains for the superintendent to deal with the consumers. The business office will take care of the satisfied consumers. He will have the dissatisfied ones to deal with, and will find plenty of opportunity to exercise his tact and judgment. It devolves upon him to load the plant at a profit, and he should exhaust his ingenuity in providing methods of selling his power. He should have a flat rate for those consumers who abhor a meter. He should be largely conversant with and prepared to adapt any of the modern systems of selling electric power as his judgment may decide. He should not lose sight of the fact that a day load that will even pay interest and depreciation charges in addition to running expenses is desirable. He should go out of his way to secure it. If a trolley line enters his town from a distant city, he should propose a rotary sub-station. He should not lose sight of the fact that it is always advisable for a central station plant to acquire cheap land suitable for factory sites on which may be founded industries which may be power consumers. His keenest business foresight will be severely taxed to determine upon the spending of money in matters like these. He should seriously investigate the feasibility of a storage battery auxiliary in order to flatten out the load curve on his generators as far as possible.

He should be on the alert to prevent the installation of private plants by means of a suitable adjustment of rates. When a consumer uses enough light or power to justify the expense of a private plant, the local company has a sufficient commercial reason for supplying him with current at a lower rate than his neighbours by reason of the larger quantity involved, and it is worth while for the electric company to make substantial reduction in order to avoid the setting of a dangerous precedent. In this department, his tact, business ability, and judgment will be taxed to their utmost.

Having outlined the versatile attainments of our ideal central station superintendent, it remains to say a few words on how these can best be acquired. Tact, good judgment, and business ability can be attained by practical experience, and in no other way. The art of managing men simply requires that the candidates shall learn by doing. The methods that the would-be superintendent will pursue necessarily depend largely upon his opportunities. If he is young and unhampered, he should devote himself to acquiring the necessary book knowledge, and all the better if he has to work in an electric light station as a stoker or even a coal passer in order to obtain the necessary funds to assist him in his studies. A boy with a high school education taking a course in a technical school, and working summers and between whiles for a dollar a day or less in the fire room with the shovel, in the engine room with a piece of waste and an oil can, or out on the line with hatchet and pliers, is laying perhaps the best possible foundation for competency as a station superintendent.

His desirable characteristics as a man have already been mentioned. To sum up his professional attainments, they should be as follows:—

1. A practical experience gained by working in electric light stations, and on distribution lines, preferably both, while operating and while in course of construction.
2. An intimate technical and practical knowledge of all the methods of generating, controlling, measuring, selling, distributing and consuming electric light and power.
3. A good all round technical and practical knowledge of steam engineering, which may in these times of water-power plants be usefully supplemented by a correspondingly through knowledge of hydraulic engineering.
4. A commercial knowledge of the electrical and mechanical market for labour, machinery and supplies.

In the present state of the art this is enough for one man to try to accomplish. For up-to-date perfection he must study and specialise his profession.

INSTITUTION OF ELECTRICAL ENGINEERS.

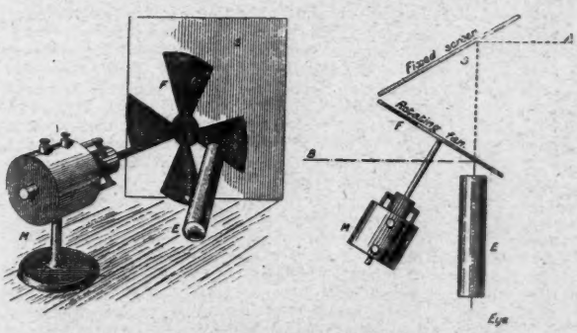
THE PHOTOMETRY OF ELECTRIC LAMPS.

By Dr. J. A. FLEMING, M.A., F.R.S., Member.

(*Abstract of Paper read December 11th*, 1902.)

(*Concluded from page* 163.)

ANOTHER variety of flicker photometer has been described by Prof. F. P. Whitman.* From a circle of white card, which is fixed to the axis of a motor, he cuts away a semicircular segment. This disc is placed on the photometer bench so as to make an angle of 30° with the line of light. Behind this disc is placed another fixed sheet of white card, inclined at an angle of 60° to the revolving disc. The two lights to be compared are placed on either side of this arrangement, and on revolving the disc and looking in the proper position we obtain intermittent glimpses of the white card behind. The brightness of the two surfaces—namely, that of the disc and the card—are then equalised by moving the lights, and this



M, Motor carrying white Maltese cross fan F; S, Fixed screen; E, Eye-tube; A and B, Two sources of light.

FIG. 10.—FLICKER PHOTOMETER.

equality in brightness is known to exist when the "flicker" just vanishes. The author has made a slight modification of the above form of flicker photometer by employing a white card disc cut in the form of a Maltese cross, with the open sectors equal in magnitude to the cross arms, and using the disc on the axis of a motor as above described (see fig. 10). Another compact form of flicker photometer devised by the writer contains in a box the screen and fan driven by clockwork at just the right speed. It is quite an easy matter to compare by means of it an arc lamp and a candle.

Prof. A. Vernon Harcourt has mentioned in a paper on "Photometry by the Pentane Standard" that his attention was drawn by Mr. Dibdin, chemist to the late Metropolitan Board of Works, to the fact that a *star disc* affords a much better means of comparing heterochromatic lights than the simple Bunsen *grease-spot disc*. In using the ordinary Bunsen grease-spot disc for the comparison of heterochromatic lights, the writer has found that the colour difficulty is partly eliminated by throwing the eye out of focus. In other words, not endeavouring to obtain too sharp a view of the object looked at.

* *Science Abstracts*, Vol. ii., Abstract No. 28. *Physical Review*, Vol. iii., p. 241, 1896. See *Proc. Brit. Association*, Aberdeen, 1885.

Before heterochromatic photometry is placed on a perfectly satisfactory basis, we require to determine and to define more closely what it is we are comparing, or desire to compare. We want, if possible, some means of defining how far any given illuminant differs from daylight in colour-revealing power for certain standard coloured surfaces.

In the next place we require to arrange and define a standard detail pattern, in order that we may determine the quality of any given light in revealing detail; and finally, with respect to the integral brightness, we have to determine and define a standard of brightness or illumination in the production of which the lights considered should be compared.

The mere term "candle-power of an arc" is unquestionably too vague to satisfy requirements at the present day, in defining the value of a given electric arc-lamp as an illuminating agent; there are peculiarities about the light emitted from the various forms of arc-lamp which render them best suited for particular forms of illumination, and not sufficient information of scientific value is gained by simply describing them as arcs of so many mean spherical candle-power, or so many watts. Our ideal light is daylight. We ought to be able to define how far any artificial light can act as a substitute for daylight in enabling us to see surrounding objects in their proper colours, with their proper details and their proper brilliancy or relative brightness.

IV.—Photometric Units.

We may in conclusion make a brief reference to the subject of photometric units and international agreements thereon. The Congress of Electricians at Geneva, in 1896, adopted as the unit of *luminous intensity* the *candle*, and defined it as being practically represented by the *decimal candle* or *bougie-decimale*, which a previous Congress in 1889 at Paris had defined as the twentieth part of the light emitted normally by 1 sq. centimetre of platinum at its melting point. The 1896 Congress further asserted that this decimal candle might be practically represented by the Hefner unit. As the unit of *luminous flux* they adopted the word *Lumen* to signify the light sent out from a unit source through a unit solid angle. Following the decision of the Congress held in 1893 at Chicago, they defined the unit of illumination as a flux of one lumen per square metre, and called it a *Lux*.* One cannot but wish that the resolutions adopted had been previously discussed in the technical press.

In the first place, the *candle* is too small a unit of luminous intensity for the purpose of electric photometry. The unit of lighting adopted now for a long time past by electrical engineers has been the 30-watt glow-lamp, which when working at 3 watts per candle gives a light of 10 candles. Again, a 10-candle lamp is now the photometric unit adopted in gas-light photometry by the Gas Referees. The Carcel lamp, the French official standard, has a value not far from 10 candles. Hence the candle is becoming a thing of the past, both as a practical illuminant and as an actual standard in photometry. A unit of light of convenient magnitude for the purposes of electric lighting is that which is given by the 30-watt glow lamp, or by the Harcourt pentane lamp as adopted by the gas referees.

Instead of calling this standard of luminous intensity *ten candles*, why not call it *one lamp*? The word *lamp* is a short, common word, existing both in French and German, and therefore not presenting anything strange in sound. It would appear that a case can certainly be made out for reckoning luminous intensity in larger units than a candle, each of which is called *one-lamp power*, and equivalent to what we now call 10 c.p. This would have another advantage, because the unit of brightness or illumination would then be the *lamp metre*, namely, brightness produced by a luminous intensity of one lamp on a white surface at a distance of one metre. This brightness would be very nearly equal to a Carcel metre, originally named a Lux by Sir W. H. Preece, and to that which we call *one candle-foot*, a convenient illumination for the purposes of vision. The candle-metre is too small an illumination to take as a standard. The least comfortable illumination for discriminating print is one 10 times as great as that called by the 1896 Congress a *lux*. The practical photometerist hardly ever feels the need for other units than those of luminous intensity and illumination. In the suggested nomenclature the unit called the *lamp* would be the name for the first, and the *lamp-metre*, which might also be called a lux if desired, would be the unit for the second.

If the Violle platinum standard should be ultimately adopted as the final standard of reference in Great Britain, the *lamp* might be defined as that light given out normally from half a square centimetre of the surface of platinum at its melting point. It could be reproduced or recovered at distant places by the use of a Harcourt pentane argand lamp, or by the use of one of the large bulb electric glow lamps taking 30 watts.

Again, why do we still adhere to that rather absurd method of measuring what is called the "efficiency" of an electric lamp by stating the *watts per candle*? This so-called efficiency is greater the less the number by which it is defined. We ought rather to specify this quantity in *lumens per watt or per kilowatt*. In lumens per watt the efficiency is a number near to 4 for a glow lamp, and 12 for a continuous-current arc, and these numbers give us at once some idea of the relative economy in working. We prefer, however, apparently to travel along old intellectual grooves, rather than strike out for a new and better way.

A more important matter, however, than the reorganisation of nomenclature is the actual establishment in England of a primary reference standard of light. At present there is no Court of Appeal in case of disputes as to the so-called candle-power of glow-lamps or arc lamps. Without presuming to dictate a course of action, it is much to be desired that this matter should engage the attention of the National Physical Laboratory without delay, and that a careful re-investigation should be made of the Violle platinum standard, and at the same time the Lummer and Kurlbaum platinum standard as adopted by the Reichsanstalt should be examined. Also experiments should be undertaken to see how far the large-bulb glow-lamps made on the plans suggested by the author can be employed as a means of distributing or reproducing this standard in distant places.

The Hefner lamp has rightly never been accepted in Great Britain, as it is not a suitable practical unit for electric photometry, but if the platinum reference standard could be set up at one or two places, and if it could be shown that the light from one square centimetre of molten platinum is practically represented by twice that given by a Harcourt pentane lamp, or by a certain glow-lamp made and used in a certain manner, the difficulties which beset photometry at the present moment from the want of a common recognised standard would be diminished. It is unfortunate that national feeling seems to enter into this question of the selection of standards of light. No sooner is one practical unit suggested in France, than a different one is adopted in Germany, and a third in England; but that is no reason why the whole question should not even now be re-examined *ab initio* by photometrical experts with the object of settling an international unit of light, and obtaining for it universal acceptance, as in the case of the international electrical units.

These suggestions are thrown out not in any dogmatic spirit, but as the result of nearly 20 years' experience in the testing of electric lamps, and in the hope that they may stimulate discussion, and enable the members of this Institution to formulate their experience and opinions on the photometry of electric lamps.

* The word *Lux* was originally suggested by Sir W. H. Preece, at the 1889 Paris Congress of Electricians, as the name for a unit of illumination, and applied by him to express an illumination equal to a *carcel-metre*, nearly equal to one *candle-foot* in magnitude.

Manchester Section.

On Tuesday, January 20th, Mr. Hardman E. Earle delivered his presidential address. He pointed out the growing importance of this section of I.E.E., the membership now numbering 450, including on its roll members representing the leading electrical industries in the surrounding districts.

Lancashire and Yorkshire would, within a comparatively short period, possess electrical generating stations which would be second to none in the country as regards either size or importance, and, notwithstanding the progress in the past, they might confidently anticipate a development in the future, which would surpass anything they had witnessed.

The rapid and even startling progress that had been recorded in every direction during the past 20 years was primarily due to the labours of those who had, by scientific investigation, enabled the engineer to solve, with an accuracy amounting almost to certainty, the problems placed before him, and in a secondary degree to the spirit of commercial enterprise which had provided so large a capital for the industry.

Within the period named the investigations, inventions, and developments which had chiefly contributed to the advancement were:—The production and commercial manufacture of the high voltage incandescent lamp; the mathematical treatment of the fundamental principles of the electric generator; the three-wire system; the series-parallel control for traction work; and the induction motor.

The first economical incandescent lamps in this country were introduced between 1881—2; they were 50-volt lamps, and consumed 3·5 watts per candle-power. Since that time great advances had been made, and higher voltage lamps are now satisfactory and efficient, and are sold for as many pence as they formerly cost shillings.

The mathematical treatment of all matters concerned in dynamo design was of the greatest importance. Machines could now be designed for almost any purpose with a certainty as to the result that was not formerly possible. The knowledge of what may be expected from various samples of iron and steel had reached a high state of perfection. In this respect it was interesting to note the gradual evolution from cast-iron to wrought-iron, and subsequently steel, which enabled machines to be produced having a higher efficiency, and less weight and cost.

The development of the multipolar dynamo had been an important step, and one of the most valuable advances had been the use of carbon brushes. Speaking generally, it had been found that high-resistance, fine-grained brushes were most valuable for the higher potentials, and low resistance course grained brushes for the lower potentials.

The great improvement in the dynamo had given strong impetus to improvement in steam engines; the accurate knowledge of steam consumption per kilowatt enabled various types to be compared, and had led to many improvements in design.

The three-wire system was introduced when the two-wire system had reached its limit; its general adoption was proof of its importance. Combined with lamps of double the previous voltage, it gave a new life to continuous-current working, and had been the cause of this system replacing the single-phase alternating-current system in many towns.

The series-parallel control for tramway work had in one great step enabled about 30 per cent. reduction to be made in the units per car-mile and in the plant to be provided in the power station.

This, combined with the development of the overhead trolley system, had been a great factor in the rapid advancement of electrical operation of tramways.

Until the introduction of large power schemes the three-phase system had not made much progress in this country; the development that had taken place, however, had necessitated the use of polyphase current for transmission, and this had created a demand for polyphase plant.

There was no rivalry between the direct and polyphase systems; each had its proper sphere, and they were becoming more closely linked together to assist in the advancement of the electrical industry.

It was interesting to consider to what degree of perfection have been arrived at, and in what direction advancement might be expected in the future. The tendency was towards the simplification of operations by which a given purpose was effected. To the most uninitiated it must be obvious that the present method of producing electric light was a most roundabout process. Taking coal having a calorific value of 14,500 units per pound, and assuming 9 lbs. of steam evaporated to 160 lbs. pressure per pound of fuel, the efficiency of the boiler and economiser was approximately 72 per cent.

An engine taking 13 lbs. of steam per I.H.P. has an efficiency of 17 per cent., or a combined efficiency with the boiler of approximately 12 per cent., and assuming B.H.P. to I.H.P. equals 90 per cent. the useful return from heat units to B.H.P. represents 10·7 per cent.; and ·7 per cent. of this figure is lost in the generator, leaving 10 per cent. of the value of the fuel in the form of electricity.

But this was not the most inefficient process; of the energy consumed in an incandescent lamp, only a small proportion of the light rays were luminous, and its general efficiency as a converter of energy into light might be taken at 3—7 per cent., or an average of 5 per cent.; thus only ½ per cent. of the energy of the coal was converted into light. The arc lamp with its better efficiency of 5—15 per cent. gave a total result of 1 per cent. coal to light. The electric motor having 90—95 per cent. efficiency gave a final result of nearly 10 per cent.; in this case the steam engine was the most inefficient factor. It was evident that for the cheaper production of light by means of the incandescent lamp, which was the least efficient member in the systems dealt with, they must look to improvement in the lamp itself. Speaking later, Mr. Earle referred to the osmium lamp, which had given an efficiency of 60 per cent, and to the mercury vapour lamp, which also had a high efficiency; these, however, were only in the experimental stage.

Turning now to generating stations, it must be evident to those who studied the published figures for coal per unit generated, that there was very great variation in the various stations. This might be accounted for to some extent by the cost of fuel, type of boilers and engines, and more particularly the load factor; but he thought the personal element entered largely into the question, and this should receive the careful consideration of all concerned. In the large power stations about to be erected, all connected with them were only too ready to take advantage of developments, improvements and inventions which may assist to further economy. They were forced to ask themselves if the reciprocating engine was to be superseded. Two other types were forcing themselves into notice, and the latest results obtained could not be ignored; these were the steam turbine and the gas engine.

With the reciprocating engine much loss was caused through leaking slide valves, condensation, temperature variation and friction; also the steam could only be expanded 8—16 times. With the turbine, however, there were none of these troubles, and the steam could be expanded 100—200-fold. The importance of a good vacuum with the turbine was emphasised; there was something attractive in the absence of valves, eccentrics and reciprocating parts in the turbine. Besides the excellent results in steam consumption, smaller first cost for plant and buildings, and inexpensive foundations, also the possibility of using the steam in the boilers without the expense of oil separators, &c, were important considerations.

The second type—the gas engine—was one that had won for itself a very high position, which was fully justified by its performances. The difficulties to be overcome had been many and great, and the improvement was due to the untiring energy of those working at the problem.

For engines designed to develop powers of 1,000 H.P. and upwards, the double-acting engine with an impulse for every stroke was certainly the most attractive, especially for driving alternators intended to run in parallel.

Mr. Earle pointed out that though there were many records of past and present performances of gas and steam plants, their value was considerably lessened owing to the various units based on different temperature scales and weights being used.

So long as gas engines were run upon town's gas their field of operations was limited to comparatively small powers, and to enable gas engines to compete with steam for the generation of power on a large scale, a cheap and reliable gas was essential. Apart from the question of producers designed especially for the manufacture of power gas, the utilisation of gases from blast furnaces and coke ovens was a problem of the very greatest importance. The waste gases resulting from the manufacture of 1 ton of pig iron, after allowing for the power required to drive the blowers, &c., will develop in a gas engine approximately 600 H.P.-hours; thus, assuming 2 lbs. of coal per H.P., with coal at 8s. per ton, the income or saving when based on the value of fuel alone, represents 3s. 2d. per ton of iron melted.

During the early years power gas was manufactured from anthracite or coke, but lately a process had been designed which enabled the cheapest bituminous coal to be used and the resulting ammonia to be recovered. This had brought the question of the use of gas, for the production of power on a large scale into prominence. Briefly comparing a 400-H.P. steam plant with a gas plant of equal power (the latter using gas manufactured from anthracite) the following results were obtained:—

Capital cost, steam plant = £5,900 approx.
" gas " = £4,500 "
Cost per H.P. per hour steam plant = ·315d.
" " gas " = ·3d.

These figures relate to a plant using expensive fuel in the gas producer, and the assumption made that both plants are running 10 hours per day on full load. When using bituminous slack in the gas producer for plants of even 500 H.P. considerable economy is shown over steam; but when the power rises to 3,000 H.P. and it becomes advantageous to recover the ammonia, the value of this bye-product reduces the net cost of the gas to a figure, so that, with coal delivered at 8s. per ton, the net cost of fuel does not exceed one-twentieth of a penny per horse-power. Such a result was one which pointed with certainty to the adoption of the gas engine for all large power plants.

In central station working a very important factor in connection with the cost per unit was the load factor. As the stations increase in size we find that the load factor approximates to 20 per cent., but if this is increased to 50 per cent. the costs fall practically to one-half. Storage batteries are the only present means for doing this, but their great capital cost alone prevents them from being used on any large scale. Apart, however, from their use for storage, there is a large field for their employment as regulators in large power stations, and it is possible to so check the fluctuations and shut the plant down that a load factor of 20 per cent. may be increased to one of 30 per cent., and the cost of generation per unit reduced approximately 20 per cent.

Mr. Earle then referred to the supply of electricity in bulk. The power companies have been excluded from giving customers a supply in certain municipal areas, but the effect of these companies, carrying on operations outside their gates, will be felt; and the low charges for power will tend to attract small manufacturing firms to districts where rates are low, and land is cheap. The load expected for lighting small areas at present having no supply is only a small percentage of that anticipated for traction and power. Considering the case of a village having a maximum demand for lighting purposes of 100 KW., he found the average price at which current could be sold by the authorised undertaker was 6d. per unit; the power being taken in bulk from the Power Co. For a 200-KW. maximum demand the charging price would be 5·9d. per unit. This was assuming a load factor of 9 per cent. for both cases. If a battery were used to bring the load factor up to 20 per cent., after all allowances for interest and depreciation, the charges would work out at 5·7d. and 5·33d. per unit respectively. These prices compared favourably with those charged by small companies having a similar output, which in many cases paid no interest on capital, and placed an altogether inadequate amount to their depreciation account.

In conclusion, Mr. Earle asked to what extent are home firms in a position to take advantage of the demand for plant in this country, and in our Colonies. He was convinced that we are in every way able to hold our own in competition. Temporary fluctuations in price based on unsound economic law will occur from time to time, and cause orders to go out of this country, but turning out machinery as good as any that is made will secure for us our full proportion of the work.

Though British machinery is capable of speaking for itself, we must not fall into the error of ignoring the excellent features in that of our rivals.

Turning to the commercial aspect, the speaker showed that the action of the Legislature had been detrimental to the advancement of the industry; this matter was now receiving the attention of members of the profession. Municipal trading, though a very proper thing if kept within bounds, had possible dangers, and the action of local authorities in opposing useful and necessary schemes, had been the cause of great waste of both time and money.

Looking back on the steady and continual progress made, and considering the opportunities that were still open in the various branches of electrical engineering, one could not help but feel with some degree of confidence that the progress in the present century will equal, if not surpass, that of the last.

A hearty vote of thanks was accorded to Mr. Earle for his excellent address.

BIRMINGHAM LOCAL SECTION.

ON Wednesday, January 21st, a large number of members of this local section accepted the invitation of the directors of the General Electric Co., Ltd., to visit their large works, which have recently been opened at Witton, near Birmingham.

After an inspection of the engineering shops, power house, foundry, carbon works, and steel conduit shop, the party was entertained to tea at the firm's club house.

The building which is known as the engineering works is employed chiefly in the construction of dynamos and motors, for both direct and alternating current, and is kept quite distinct from the buildings which are given up to the manufacture of carbons, and to steel conduit construction.

The power house occupies a separate building, in which are installed three high-speed steam dynamos, the largest set being a Galloway engine coupled to a "Byng-Hawkins" 8-pole direct current generator, with an output of 350 KW.

Apparently the firm is making a speciality of polyphase machinery, and a large boring mill has been installed capable of dealing with polyphase generators up to 2,000 KW. This machine is capable of operating on a piece of work up to 24 ft. in diameter. Attention was also attracted by a large surface bed equipped with portable tools for dealing with the heaviest classes of work. The generators in the power house have been wound for 460 volts, working on a three-wire network, three-phase testing being provided for by a motor-generator.

Amongst the polyphase machines in hand were two 200 B.H.P. motors which the company is making for the Denaby Main Collieries, and on the direct current side three 350-KW. machines which are being built for the new Kleinfontein Co., South Africa. In the carbon works, various machines were to be seen making carbon plates for batteries, and carbons for arc lamps and searchlights from 6 mm. diameter to 45 mm. The large high temperature ovens for baking carbons aroused considerable interest.

After tea was partaken of, a vote of thanks was proposed by the chairman, Mr. Henry Lea, who expressed the thanks of those present to the firm for their kindness in permitting the visit and for their hospitality. Mr. Hirst, on behalf of the General Electric Co., replied, saying how pleased they were to have the opportunity of welcoming them, and hoped that they should see them again at some future date.

THE CONTINENTAL ELECTRICAL INDUSTRY.

The first Retaliation against the New German Tariff. The General Position of Affairs Unsatisfactory.

The first country in Europe to propose retaliatory measures against the New German Customs Tariff is Norway, which will be severely hit when the higher duties are brought into operation in the Fatherland. A revision of the Swedish duties came into force at the beginning of January, and the Norwegian Government has now prepared a project which contemplates the abolition of various free entries, and the imposition of higher duties in other cases. Apart from agricultural machinery, which will continue to be imported free of duty, the Government proposes to subject all other machinery or parts thereof to an *ad valorem* duty of 5 per cent. This rate will apply to motors, cranes, dynamos, transformers, and safety appliances. The new tariff is largely aimed at Germany, and other nations may be expected to follow the example of Norway in a short time from the present.

The association for the preservation of the common interests of the German electrical industry—the formation of which was announced in these columns some time ago—met recently at Frankfort-on-the-Maine, under the presidency of Herr A. Haeffner. It appears from the report presented that nearly all the firms concerned have become members of the association, and relations have been established with the Imperial and State authorities, whereby the association receives valuable communications from various quarters, and its efforts are supported in other directions. As far as the extension of the export trade is concerned, the report showed that by means of carefully collected material, the association circulates many important hints among its members, and it is intended to devote special attention to this department in the future. The office of the association has gradually developed into an organisation which seeks to further the interests of the members by imparting information regarding all economic and legal questions, and the various branches of the industry are represented by six groups or committees.

The representative character of the association may be judged from the following list of the governing body:- President of Council, Herr A. Haeffner, of Voigt & Haeffner; acting president, E. Rasch, Mix & Genest Co.; treasurer, E. J. von der Heyde, of Berlin; and Councillors, Herren E. Adt, of the Adt Co.; H. Garbe, of the German Electricity Works (Garbe, Lahmeyer & Co.), Aix-la-Chapelle; T. Grosswendt, Land and Marine Cable Co., of Cologne-Nippes; Max Körting, of the Körting & Mathiesen Co., Leutzsch, near Leipsig; G. Victor Lynen, of Lynen & Co., Stolberg; and E. Sieg, of the Cologne Accumulator Works, of Kalk, near Cologne.

French Companies.

The shareholders of the Compagnie Thomson-Houston were recently called together in extraordinary meeting for the purpose of considering the question of dealing with the special reserve fund of £1,000,000. At present the company has an ordinary share capital of £1,600,000, founder's shares of £80,000 and a bond issue of £1,200,000, and in addition to manufacturing electrical machinery and promoting tramways, the company has become financially interested in other electrical enterprises which have suffered from unfavourable circumstances but which, it is said, will not involve any actual loss to the parent undertaking. According to a statement made by M. Guillain, the new chairman of the company, the special reserve fund of £1,000,000 is the result of the premiums realised on the last issue of shares, and the whole of this sum is being devoted to the writing down of the securities in the company's portfolio in order to allow of the payment of the usual dividend for the past year.

The Société Industrielle des Telephones had a less satisfactory period during 1901-1902 than in the preceding financial year. The gross profits amounted to £92,158, as compared with £154,570, and the net profits to £46,940, as against £108,900. A dividend has been declared at the rate of 12 frs. per 300 frs. share, or 6 frs. less than in each of the two previous 12 months. It was recently reported that the company had arrived at an agreement with the Government for the construction of a cable to be laid between Brest and Dakar at a cost of about £640,000, but it is not quite clear whether a contract has already been entered into for this purpose. At any rate M. Richemond, chairman of the council of administration, was apparently referring to this question when he informed the shareholders at the recent general meeting that perfect accord now existed with the Ministry, and that the latter would do everything to bring the scheme to a successful issue; but that it was left to the Chambers, which would have to vote the necessary credits, to decide the matter.

The position of the Compagnie Générale d'Electricité, as revealed by the report for the year 1901-02, is far from satisfactory, and although a dividend at the rate of 25 frs. per share was paid a year ago, it is impossible for the company to make any distribution for the past financial year. The net profits amount to £34,934 as compared with £50,560 in the previous year, but the former is practically absorbed by the necessity for writing down the value of the stocks of metal to the extent of £22,900, and by the sum of £12,000 for the depreciation of securities. As the company's ready means have been reduced from £60,000 to £20,000 and its liabilities advanced from £100,000 to £160,000, it will be apparent that the company has passed through a somewhat unfortunate year.

The Compagnie Parisienne de l'Air Comprimé does not appear as if it will ever emerge successfully from the difficulties which surround it. Originally established with the assistance of the German Disconto Gesellschaft for the development of the Popp compressed air system in Paris, the company speedily found it necessary to relegate this method to the background, and devote its energies mainly to the supply of electricity from steam units, but notwithstanding a gradual progress of both branches, the uncertainty of the company's tenure renders impossible any distribution of profits among the shareholders. Hence it happens that the profits are annually placed to a special fund for the redemption of the capital expenditure. The report for 1901-02 shows an increase in the revenue both from the sale of electrical energy and compressed air, the total net profits amounting to £128,250 as compared with £99,060 in the preceding year. This sum has been transferred to the special redemption fund, which has now reached a total of £363,000, whereas the capital expenditure already amounts to £1,974,400. During the year the floating debt has been reduced from £658,000 to £550,800. The idea of the Western Railway Co. adopting compressed air for the working of the line Invalides-Champ de Mars, has apparently been abandoned, there now being no longer any reference to the question in the compressed air company's report.

German Undertakings.

The Berliner Telephone Works Co., of Hanover, which was formed about five years ago, and which has now carried through an increase in the capital from £75,000 to £100,000, which was sanctioned last September, has experienced a disastrous year. In the first three years of its existence in its present form, the company was successful in paying dividends of 12 per cent., 14 per cent., and 9 per cent. respectively, but any distribution for 1901-1902 is entirely out of the question. The accounts show, as compared with a net profit of £10,396 a year ago, a loss of £3,456, which is partly met by the balance from the previous year, and partly by drawing upon the reserve fund. The unsatisfactory results are attributed to a variety of causes. In the first place, the Berlin and Budapesth branches did not receive the large orders formerly given by the Governments, and the stocks at the latter branch had, after careful and fresh calculations, to be considerably written down. The manufacture of telegraph articles commenced by the Vienna branch required greater expenditure, and the report states that the branches in London and Paris, although exhibiting a continuous increase in sales, necessitated grants towards the costs of organisation. The company's report further states that unfavourable effects were in general produced by inland and foreign competition, although the circle of customers has been considerably extended and the manufacture has been commenced of a number of new apparatus. So far, however, as the current financial year has proceeded there has been an increase of 60 per cent. in the goods invoiced as compared with the equivalent period of last year; the orders are considerably greater and the directors hope the present year will witness a return to normal results.

The Insulated Wire Works (late C. J. Vogel) Co., of Berlin, suffered more from the effects of the general depression during the year ended September 30th than in the preceding 12 months. The sales not only declined, but prices were also further depressed owing to the severity of the competition in this branch. The report of the directors is not accompanied by a balance sheet and profit and loss account. It states, however, that the net profits amount to £1,146 as against £2,318, and a dividend at the rate of 2 per cent. has been declared as against 4 per cent. in 1900-1901. The prospects for the present year are shaping more favourably as sales and orders have largely increased.

Among other concerns may be mentioned the Electric Light and Power Investment Co., of Berlin, which has just distributed a dividend of 3 per cent. as against 5 per cent. in 1900-1901. Besides being financially interested in various German and foreign lighting

and tramway undertakings, the company has acquired a parcel of shares in the London Underground Railways Co. The Siemens Electrical Management Co. is distributing 5 per cent. as in the previous year; the Brazilian Electricity Co., of Berlin, 5 per cent. as in 1900-1901; and the Continental Telegraph Co., of Berlin, 11¼ per cent. as compared with 9¼ in the preceding year.

SWISS, RUSSIAN AND AUSTRIAN COMPANIES.

The Oerlikon Machine Works Co. has experienced a set back during the year 1901-1902. It has a paid-up capital of £240,000 out of a total issue of £280,000, and bonds amounting to £160,000. The report of the directors shows that after providing £20,000 for depreciation as against £25,600 in the preceding year, and including the balance brought forward, the net profits total £16,950 as compared with £32,330 in 1900-1901. It is proposed to pay a dividend of 5 per cent. as compared with 10 per cent. for the previous 12 months. The report deals with the position of the electrical industry, and mentions that the construction of steam turbines has now been commenced, and the prospect opened of important business being done in this branch. The company has been able fully to maintain its sales during the year, and the co-operation of the branches at Rome, Madrid, Milan and Lausanne, notwithstanding the considerable expenses attaching to them, has proved of advantage. The report states that the unfavourable condition of the electrical industry affects the company mainly in regard to prices and less in respect of the sales of plant.

The report for 1901-1902 of the Russian Siemens & Halske Co., of St. Petersburg, which has a paid-up capital of 7,000,000 roubles, states that the position of the electrical industry in that country is very unsatisfactory, and it hints at the future possibility of manufacturing operations being restricted to certain specialities, and the remainder of the requirements of Russia being met by imports. Although the company realised net profits amounting to 259,580 roubles in the year 1900-1901, and paid a dividend at the rate of 2½ per cent, the past year's trading has closed with a loss of 299,690 roubles, about 60 per cent. of which is due to the operations of the branch establishments. This loss is partly covered by drawing upon the reserve fund for 101,485 roubles, whilst the balance has been carried forward to the debit of profit and loss account. The report attributes the unfavourable results to the further heavy decline in prices and the unsatisfactory conditions of sale, whereby the turnover diminished by 25 per cent., and the gross profits by 50 per cent. as compared with the preceding year. This is the position of affairs notwithstanding the fact that the company is exclusively concerned with manufacturing operations and the transactions incidental to the disposal of its production.

The Austrian Schuckert Co., of Vienna, which restricts its operations to the manufacture of plant and the equipment of central stations, tramways and other works, has succeeded in maintaining during 1901-1902, the satisfactory position attained in the previous 12 months. Including the balance brought forward the net profits amount to 729,155 kronen, as compared with 699,550 kronen a year ago, and out of the former a dividend at the rate of 7 per cent. has been declared, this being equal to the distribution for 1900-1901. During the year the company completed the construction and equipment of a large central station for the municipal authorities of Vienna, and is now engaged in converting to electric traction 19 miles of tramways, which have been acquired by the same body from the new Vienna company. On the completion of this undertaking, the company will proceed with the establishment of electric traction on the Vienna-Boden section of the Vienna Local Railway Co. The report mentions that 841 dynamos of a total of 21,320 H.P. were delivered during the year, as against 783 generators, and 21,220 H.P. in the preceding 12 months. It appears that the interest of the German Schuckert Co. in the Austrian Co., which some time ago exceeded £88,000, is now represented by about £65,000.

The Austrian Felten & Guilleaume Cable Co., of Vienna, has had under consideration for some time the question of acquiring the Buda Pesth branch of the German Felten & Guilleaume Co., of Mulheim, and a meeting of the shareholders was convened to sanction an increase in the share capital from 6,000,000 kronen to 7,000,000 kronen for this purpose. When the assembly took place it was found that the branch of the Rhenish company had just been transformed into an independent Hungarian company with a capital of 1,000,000 kronen, and the scheme for raising fresh capital was therefore abandoned. It now appears to be the intention of the Austrian F. & G. Cable Company to form a separate company to represent its interests in the Hungarian capital.

THE LONDON CHAMBER OF COMMERCE AND MUNICIPAL TRADING.

AN after-dinner debate, under the genial presidency of Lord Avebury, is a pleasant way of discussing the problem of municipal trading, but there is always the difficulty of getting speakers to keep to the point, however well the chairman may strike the keynote in his opening speech.

The dinner at the Trocadero Restaurant on the 21st inst. was no exception to the rule. Lord Avebury put the case of the anti-municipal traders temperately, but forcibly, pointing out the principle contended for by "honest John Burns," viz., that all trading should be in the hands of labour-governed municipalities, which would, of course, abolish private enterprise altogether. This was the real question for discussion—the deprivation of the ratepayers—of the exercise of their industries in exchange for the very problematical share of profits to be derived from the trading by their Local Governments.

This is the Socialist ideal which, of course, is impracticable, but in the meanwhile how much loss will be sustained by the departure in any way from the principle of limiting municipalties to their legitimate duties in connection with the Local Government of their districts?

With the exception of Mr. Garcke, who, at the close of the discussion, spoke upon the principle underlying municipal trading, the speeches dealt with illustrations more or less pertinent, of its results.

After the chairman's address, Lord Monkswell opened the discussion with a defence of the London County Council and an attack upon the Moderate section, who he accused of being more industrious in criticising the Progressive party than in attending to the hard work of the committees.

Then Mr. Fletcher, L.C.C., accused Works Committeemen of profound ignorance of, and unfitness for, their business because they did not know how many bricks a man ought to lay in a day. Then Mr. Percy Harris, another distinguished L.C.C., took up the running, followed by the Agent-General for New Zealand with all the precocity of the teacher of grandmothers in the art of sucking eggs, and he settled the question of municipal trading by quoting the example of his Colony.

Mr. Arthur Kay illustrated the dangers of municipal trading by the losses and liabilities of Glasgow, while Alderman Pearson defended the system by quoting the case of Bristol, where he claimed successful results, even after providing for depreciation and antiquation, to which he applied a mixture of sinking and reserve funds, which we could understand better if the actual accounts were before us.

Mr. Marlow Reid, the Wood Green champion of municipal trading, appeared to be quite relieved to find so many advocates of the system among the speakers who preceded him, but he was only a theorist, and, like the rest of the Socialist party, did not deal with the great principle involved.

Mr. Garcke hit the nail on the head when he pointed out that private traders were entitled to make profits as well as take risks, while local authorities had no right to do either.

Illustrations of the results of departing from this principle, whether showing apparent profits or losses, do not meet the case. If local authorities are to trade in competition with their ratepayers, and their money or credit, the community must suffer, and even involve the risk of municipal bankruptcy.

The question is so serious that the re-appointment of the Joint Committee, or the taking of evidence by a Royal Commission, is absolutely necessary, in order to enlighten the public as to the character and extent of the trading which is creating so much alarm.

Cases like that of the Corporation of Hackney, to which we directed attention in a recent issue (ELECTRICAL REVIEW, January 9th, 1903, p. 56), require thorough investigation, and it is strange that no allusion was made to it in the discussion at the London Chamber of Commerce dinner. Here we have an official auditor reporting upon an extraordinary state of accounts, a demand for inquiry by a large body of ratepayers, inability on the part of the Local Government Board to undertake it, while enormous losses have been incurred by the electric supply undertaking, estimated at over £13,000 on the first 11 months, apart from the sinking fund of some £17,500 per annum more, the provision of which is suspended for three years, when it must come out of the rates.

It is significant that the Corporation does not adopt any measures for promoting a full and impartial inquiry into the serious allegations of the district auditor, and the demands of the ratepayers for an investigation which will put them in possession of the actual facts of the case.

Lord Claud Hamilton, speaking at the same time in another place, agreed with the views expressed by Lord Avebury, the following remark being especially pertinent: "Business men could not be expected to give their time to municipal duties when these involved attendance upon Committees for the management of undertakings competing possibly with industries in which as private traders they were interested."

Lord Avebury declared that municipal trading never has paid and never can pay; but whether it can or not, the principle remains that it forms no legitimate part of the duties for which local authorities exist.

NEW PATENTS APPLIED FOR, 1903.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

775. "Improved construction of coin-freed measuring apparatus for electric current." G. SMITH. January 12th.

778. "Improved device for indicating the condition of the electric circuit controlling the air brake valves." SIEMENS BROS. & Co., LTD. (Siemens and Halske Aktien-Gesellschaft.) January 12th.

813. "Improvements in electrical batteries." H. CSANYI and G. VON BARCZAY. January 13th. (Complete.)

896. "Improvements in electric arc lamps." THE BRITISH THOMSON-HOUSTON CO., LTD., and E. J. MURPHY. January 13th.

934. "Improvements in automatic electric switches or circuit-breakers." THE BRITISH THOMSON-HOUSTON CO., LTD., and F. HOLDEN. January 14th.

941. "Improvements in incandescent electric lamps." W. R. SMITH and H. P. DRINKWATER. January 14th.

964. "Process of electrolytic manufacture of aluminium." G. GIN. January 14th. (Complete.)

986. "Improved lifeguard for electric tramcars." J. ROBINSON and W. C. PICKEN. January 14th.

997. "Electric time check for automatic machines." J. S. RICHARDSON. January 14th.

1,006. "Improvements in or in connection with the trolley arms used on electric tramcars and like vehicles." J. W. WILKINSON. January 15th.

1,031. "Improvements in rheostats." G. H. WHITTINGHAM. (Date applied for under Patents, Act, 1901, January 21st, 1902, being date of application in United States.) January 15th.

1,039. "Improvements in radiators for Hertzian wave telegraphy." J. A. FLEMING. January 15th.

1,040. "Improvements in incandescence electric lamps." E. SCHATTNER. January 15th.

1,054. "Improvements in fuse pillar boxes." CALLENDER'S CABLE AND CONSTRUCTION CO., LTD., and J. C. A. WARD. January 15th.

1,057. "Improvements in thumb-pieces for electrical switches." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,058. "Improvements in electric switches." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,059. "Improvements in hangers for overhead electric conductors." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,060. "Improvements in electrrc fuses or cut-outs." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,061. "Improvements in clips for electric switches and method of making the same." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,063. "Improvements in electric arc lamps." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,064. "Improvements in electric switches." E. A. CAROLAN. (The General Electric Co , United States.) January 15th.

1,065. "Improvements in electric couplings or connectors." E. A. CAROLAN. (The General Electric Co , United States.) January 15th.

1,066. "Improvements in combined electric switches and cut-outs." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,067. "Improvements in and relating to electrical measuring instruments." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,068. "Improvements in method of and means for generating and distributing alternating electric current." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,069. "Improvements in electric railways." E. A. CAROLAN. (The General Electric Co., United States.) January 15th.

1,070. "Improvements in electric arc lamps." O. EFREM and R. SCHWARZ. January 15th.

1,077. "Improvements in or relating to couplings for electric and other wires." A. J. BOULT. (W. Hofmann, Germany.) January 15th.

1,092. "Improvements in and relating to electro-magnetic apparatus." L. L. GUEDON. January 15th.

1,095. "Improvements in electric lighting systems." J. F. MCELROY. January 15th. (Complete.)

1,132. "Improvements in cord-grips and in the means for holding and securing cords and wires intended more especially for securing flexible electrical conductors to electric lampholders and electric supply fittings." H. L. DIXON. January 16th.

1,144. "Improvements in telegraph keys." G. L. HOGAN. January 16th.

1,155. "Improvements in the manufacture of electric cables." W. T. HENLEY'S TELEGRAPH WORKS, LTD., and J. H. W. PFIFFNER. January 16th.

1,171. "Improved appliances for use with telephones." C. S. F. MELLOR. January 16th.

1,177. "Improved apparatus for testing electrical meters." W. CORIN. January 16th.

1,210. "An automatic switch for motor bicycles and tricycles." J. M. UTLEY. January 17th.

1,227. "Improved appliance for fastening incandescent electric lamps in their sockets." A LANDSBERGER. January 17th. (Complete.)

1,233. "Improvements relating to electric telegraph apparatus." J. A. L. DEARLOVE. January 17th.

PUBLISHED SPECIFICATIONS, 1901.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

11,293. "Improvements relating to the utilisation of electro-magnetic light or other like radiation effects or disturbances transmitted through the natural media and to apparatus therefor." H. H. Lake. (N. Tesla.) Dated June 1st, 1901.

11,307. "Improvements in overhead trolleys or collectors for electric tramway or railway vehicles." R. H. Wilkinson. Dated June 3rd, 1901.

11,338. "Improvements in and relating to joints for conducting cables." L. Holmes. Dated June 3rd, 1901.

11,315. "Improvements in regulators for electric motors." D. Mackay and H. Solater. Dated June 3rd, 1901.

11,327. "Improvements in and relating to the electric transmission of signs and sounds." S. Musits, R. H. de S. György and E. Hagyi-Ristic. Dated June 3rd, 1901.

11,349. "Improvements in syntonic space telegraphy." O. J. Lodge and A. Muirhead. Dated June 3rd, 1901. Patent not yet due for sealing. Relates to syntonic telegraphy and embodies features described in Specifications Nos. 11,575, 16,405, 18,644 and 29,069, A.D. 1897.

11,408. "Improvements in electric railways on a sectional conductor or the like system." British Thomson-Houston Co. (B. B. Stewart.) Dated June 4th, 1901.

11,469. "Improvements in insulating supports or 'insulators' for electric conductors." A. Anderson and J. M. Andersen. Dated June 4th, 1901.

11,470. "Improvements in printing telegraphs." R. A. Fowden. Dated June 4th, 1901.

11,529. "Improved manufacture of electric lighting, heating and resistance bodies." W. Boehm. Dated June 5th, 1901.

11,530. "Improvements in or relating to electric glow lamps." W. Boehm. Dated June 5th, 1901.

11,548. "Improvements in safety devices for automatically disconnecting the current supply to trolley wires used for electric traction." W. A. Heyes and L. O. Heyes. Dated June 6th, 1901.

11,597. "Improved automatic fire alarm apparatus." G. Spangenberg. Dated June 6th, 1901.

11,676. "Improvements in rheostat elements or resistance boxes." T. S. Perkins. Dated June 7th, 1901. (Date applied for under Sec. 103 of Patents &c., Act, 1883, November 9th, 1901.)

11,677. "Improvements in protecting devices for the coils of electrical apparatus." P. H. Thomas. Dated June 7th, 1901. (Date applied for under Sec. 103 of Patents, &c., Act, 1883, November 9th, 1900.)

11,703. "Improvements in electrical distribution boards." C. Grundy. Dated June 7th, 1901.

11,709. "Improved construction of contact maker or current conductor for electric motors." W. L. Allcroft. Dated June 7th, 1901.

11,847. "Improvements in or relating to electrometers." G. L. Addenbrooke. Dated June 10th, 1901.

11,857. "Improvements in armature windings for dynamo-electric machines." E. Arnold and F. Collischonn. Dated June 10th, 1901.

11,923. "Improvements in or relating to electric meters, motors, and phase compensations for electric currents influencing them." L. Gutmann. Dated June 11th, 1901.

11,925. "Improvements in apparatus for connecting the ends of electric cables and the like." H. H. Lake. (F. H. Stillman, U.S.A.) Dated June 11th, 1901.

11,931. "Improved method of regulating and controlling the speed or power of electric motors." W. L. Allcroft. Dated June 11th, 1901.

11,948. "Improvements in or relating to captive balloons." F. Lombard. Dated June 11th, 1901.

11,949. "Improvements in electric telegraph apparatus." F. H. Littlefield. Dated June 11th, 1901.

11,951. "Ampere-meter for the registration of the maximum consumption of electrical current." H. Helberger. Dated June 11th, 1901.

11,992. "Improvements in means for accentuating electric contacts." British Thomson-Houston Co. (E. Thomson.) Dated June 12th, 1901.

12,016. "Framework for alternating current electrical machines." Siemens Bros. & Co. (Siemens & Halske Aktiengesellschaft.) Dated June 12th, 1901.

12,088. "Improved methods of and means for taking electric current from transformers." G. Weissmann. Dated June 13th, 1901. (Date applied for under Sec. 103 of Patents, &c., Act, 1883, December 5th, 1900.)

12,094. "Improvements in electric cables." F. Tremain. Dated June 13th, 1901.

12,119. "A new or improved method of and combination of apparatus for translating and relaying telegraph cable signals." J. P. Gorton. Dated June 13th, 1901.

12,134. "Improvements in or relating to electric arc lamps and electrodes therefor." C. A. Lee. Dated June 14th, 1901.

12,186. "Improvements in the electrolytic production of lead dioxide." G. W. Johnson. (Chemische Fabrik Griesheim-Elektron.) Dated June 14th, 1901.

12,210. "Improvements in electrostatic separators." C. E. Dolbear. Dated June 14th, 1901.

12,220. "Improvements in electric telegraphy." P. M. Justice. (Rowland Telegraphic Co.) Dated June 14th, 1901.

12,241. "Improved manufacture of electric illuminating bodies." W. Boehm. Dated June 15th, 1901.

12,250. "Improvements in and connected with the manufacture or production of chromium compounds and alkalies." G. W. Johnson. (Chemische Fabrik Griesheim-Elektron.) Dated June 15th, 1901.

12,339. "Improvements in electric motors." A. O'N. Fox. Dated June 17th, 1901.

12,392. "Improvements in portable electrically-driven drilling apparatus" G. F. Campbell and S. T. Isherwood. Dated June 18th, 1901.

12,404. "Improvements in and relating to static rectifiers and other electrical apparatus for producing or maintaining continuous or unidirectional discharges." T. B. Kinraide. Dated June 18th, 1901.

12,466. "Improvements in and apparatus for deriving electrical currents of one direction from a source of alternating current." Siemens Bros. & Co. (Siemens & Halske Actiengesellschaft.) Dated June 18th, 1901.

11,469. "An improved current transformer for telephones." B. J. Berthelon. Dated June 18th, 1901.

12,587. "Improvements in and relating to apparatus for lighting and heating by means of electric lamps." R. W. Boyd. Dated June 20th, 1901.

12,589. "Improvements in and relating to the manufacture of glass stone." L. A. Garchey. Dated June 20th, 1901.

12,720. "Improvements in or connected with electric cables for three-phase alternating currents." W. B. Esson. Dated June 21st, 1901.

12,739. "Improvements in or relating to the driving of centrifugal and other machines by means of electric motors." G. Pott and R. Williamson. Dated June 22nd, 1901.

12,773. "Improvements in electric energy meters." J. Battle and J. Bueno. Dated June 22nd, 1901.

12,816. "Improvements in wireless telegraphy." H. Shoemaker. (Date applied for under Sec. 103 of Patents, &c., Act, 1883, January 22nd.) Dated June 24th, 1901.

12,862. "Improvements in connection with electric cables or conductors where branch terminals are used, especially applicable to the wiring of electrically-driven vehicles." P. Dawson. Dated June 24th, 1901.

12,896. "A device for use within electric ceiling roses and the like." W. G. Stones. Dated June 25th, 1901.

12,947. "An improved electric telegraph code." H. H. Lake. (C. G. Burke.) Dated June 25th, 1901.

12,954. "Improvements in electrical secondary or storage batteries or accumulators." W. Peto. (P. Gouin.) Dated June 25th, 1901.

12,974. "Apparatus for making secondary battery plates and plates for other purposes." A. F. Madden. (Date applied for under Sec. 103 of Patents, &c., Act, 1883, March 19th.) Dated June 25th, 1901.

12,975. "Secondary batteries." A. F. Madden. (Date applied for under Sec. 103 of Patents, &c., Act, 1883, March 19th.) Dated June 25th, 1901.

13,010. "An improved telephone and bell set." M. Byng and F. G. Bell. Dated June 26th, 1901.

13,017. "Recording apparatus for electrical measuring instruments." A. Hill. Dated June 26th, 1901.

13,033. "A polyphase electric motor." Siemens Bros. & Co. and F. Lydall. Dated June 26th, 1901.

13,044. "A spark-spreading device for lightning arresters." H. A. Bertram. Dated June 26th, 1901.

13,048. "Improvements in electrodes for accumulators." A. Tribelhorn. Dated June 26th, 1901.

13,078. "Improvements in electric accumulators." G. J. Gibbs. Dated June 27th, 1901.

13,142. "Improvements in the construction of commutator trimming apparatus." J. Phillips. (Patent not yet due for sealing.) Dated June 27th, 1901.

13,159. "Improvements in resistance switches and automatic cut-outs for starting, protecting and regulating electric motors and their circuits." J. Edmondson. Dated June 28th, 1901.

13,229. "Improvements in alternating current motors." C. Wüst-Kunz. Dated June 28th, 1901.

13,256. "A new or improved process for transferring several telegrams in both directions by means of a single wire." R. Scharf. Dated June 29th, 1901.

13,266. "Improvements in automatic time switches." S. Jevons and C. H. Offord. Dated June 29th, 1901.

13,300. "Improvements relating to the manufacture of electrode plates and secondary electric batteries." A. Nodon. (Date applied for under Sec. 103 of Patents, &c., Act, 1883, December 1st, 1900.) Dated June 29th, 1901.